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NATIONAL DAM SAFETY PROGRAM. LOST LAKE DAM (MO10212), MISSISSIP--ETC(U)
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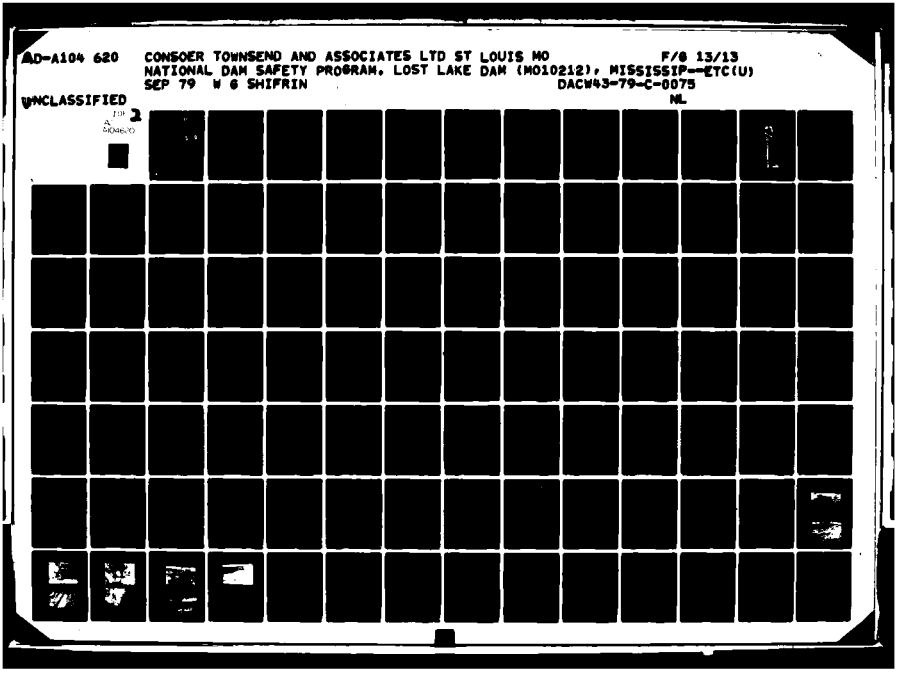

LEVEL II

MISSISSIPPI·SALT·QUINCY RIVER BASIN

LOST LAKE DAM
LINCOLN COUNTY, MISSOURI
MO. 10212

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

United States Army
Corps of Engineers
...Serving the Army
...Serving the Nation

St. Louis District

PREPARED BY: U. S. ARMY ENGINEER DISTRICT, ST. LOUIS

FOR: STATE OF MISSOURI

SEPTEMBER 1979

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1. REPORT NUMBER	2. GOVT ACCESSION NO. AD-A104	3. RECIPIENT'S CATALOG NUMBER 620
4. TITLE (and Subtitle) Phase I Dam Inspection Report National Dam Safety Program Lost Lake Dam (MO 10212) Lincoln County, Missouri		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) Consoer, Townsend and Associates, Ltd.		8. CONTRACT OR GRANT NUMBER(s) DACW43-79-C-0075 ✓
9. PERFORMING ORGANIZATION NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS
11. CONTROLLING OFFICE NAME AND ADDRESS U.S. Army Engineer District, St. Louis Dam Inventory and Inspection Section, LMSED-PD 210 Tucker Blvd., North, St. Louis, Mo. 63101		12. REPORT DATE September 1979
		13. NUMBER OF PAGES Approximately 90
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) UNCLASSIFIED
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

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17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

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Dam Safety, Lake, Dam Inspection, Private Dams

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report was prepared under the National Program of Inspection of Non-Federal Dams. This report assesses the general condition of the dam with respect to safety, based on available data and on visual inspection, to determine if the dam poses hazards to human life or property.

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DEPARTMENT OF THE ARMY
ST. LOUIS DISTRICT, CORPS OF ENGINEERS
210 NORTH 12TH STREET
ST. LOUIS, MISSOURI 63101

IN REPLY REFER TO

SUBJECT: Lost Lake Dam (Mo. 10212) Phase I Inspection Report

This report presents the results of field inspection and evaluation of the Lost Lake Dam (Mo. 10212).

It was prepared under the National Program of Inspection of Non-Federal Dams.

SUBMITTED BY: SIGNED
Chief, Engineering Division

28 SEP 1979
Date

APPROVED BY:
Colonel, CE, District Engineer

Date

LOST LAKE DAM

LINCOLN COUNTY, MISSOURI

MISSOURI INVENTORY NO. 10212

PHASE I INSPECTION REPORT

NATIONAL DAM SAFETY PROGRAM

Lost Lake Dam (~~Inventory Number~~ MO 10212)
Mississippi-Salt-Quincy River Basin,
Lincoln County, Missouri.
Phase I Inspection Report.

PREPARED BY

CONSOER, TOWNSEND AND ASSOCIATES LTD.

ST. LOUIS, MISSOURI

AND

ENGINEERING CONSULTANTS, INC.

ENGLEWOOD, COLORADO

A JOINT VENTURE

UNDER DIRECTION OF

ST. LOUIS DISTRICT, CORPS OF ENGINEERS

FOR

GOVERNOR OF MISSOURI

SEPTEMBER 1979

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

Name of Dam:	Lost Lake Dam, Missouri Inv. No. 10212
State Located:	Missouri
County Located:	Lincoln
Stream:	Lost Creek
Date of Inspection:	June 15, 1979

Assessment of General Condition

Lost Lake Dam was inspected by the engineering firms of Consoer, Townsend and Associates LTD., and Engineering Consultants, Inc. (A Joint Venture) of St. Louis, Missouri using the "Recommended Guidelines for Safety Inspection of Dams". These guidelines were developed by the Chief of Engineers, U.S. Army, Washington, D.C., with the help of Federal and State agencies, professional engineering organizations, and private engineers. The resulting guidelines are considered to represent a consensus of the engineering profession.

The overall structural condition of the dam appears to be good. The dam does not exhibit signs of structural instability. The dam appears adequately maintained.

Based on the criteria in the guidelines, the dam is in the high hazard potential classification, which means that loss of life and appreciable property loss could occur in the event of failure of the dam. The estimated damage zone extends approximately 3.5 miles downstream of the dam. Within the damage zone are three dwellings, two buildings and a quarry and plant which may be subjected to flooding, with possible damage and/or destruction, and possible loss of life. The Lost Lake Dam is in the small size classification since it is less than 40 feet high and impounds less than 1,000 acre-feet of water.

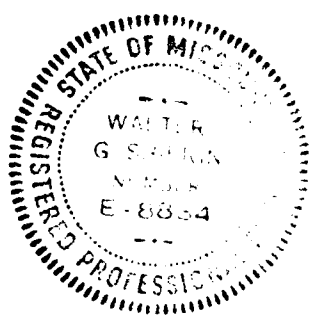
Our inspection and evaluation indicate that the spillway of Lost Lake Dam does not meet the criteria set forth in the guidelines for a dam having the above size and hazard potential. Lost Lake Dam being a small size dam, with a high hazard potential, is required by the guidelines to pass from one-half Probable Maximum Flood to the Probable Maximum Flood without overtopping. Since there is high hazard potential downstream of the dam, the appropriate spillway design flood for this dam is the Probable Maximum Flood. It was determined that the reservoir/spillway system can accomodate 81 percent of the Probable Maximum Flood without overtopping the dam. Our evaluation indicates that the reservoir/spillway system will accomodate the 100-year flood without overtopping the dam.

The Probable Maximum Flood is defined as the flood discharge that may be expected from the most severe combination of critical meteorological and hydrologic conditions that are reasonably possible in the region. The 100-year flood is defined as a flood having a one percent chance of being equalled or exceeded during any given year.

Other conditions noted by the inspection team were: minor seepage at the principal spillway outlet; minor erosion on the upstream slope; tall grass growing around the principal spillway intake; and minor erosion near the crest at the left abutment.

The absence of seepage and stability analyses is a deficiency which should be corrected. Deficiency in the spillway capacity should also be corrected. Periodic inspections by a qualified engineer and establishing a maintenance log are recommended.

Walter G. Shifrin, P.E.



Overview of Lost Lake Dam

PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LOST LAKE DAM, I.D. No. 10212

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PHASE I INSPECTION REPORT
NATIONAL DAM SAFETY PROGRAM

LOST LAKE DAM, Missouri Inv. No. 10212

SECTION 1: PROJECT INFORMATION

1.1 General

a. Authority

The Dam Inspection Act, Public Law 92-367 of August, 1972, authorizes the Secretary of the Army, through the Corps of Engineers, to initiate a national program of dam inspections. Inspection for the Lost Lake Dam was carried out under Contract DACW 43-79-C-0075 to the Department of the Army, St. Louis District, Corps of Engineers, by the engineering firms of Consoer, Townsend & Associates Ltd., and Engineering Consultants, Inc. (A Joint Venture), of St. Louis, Missouri.

b. Purpose of Inspection

The visual inspection of the Lost Lake Dam was made on June 15, 1979. The purpose of the inspection was to make a general assessment as to the structural integrity and operational adequacy of the dam embankment and its appurtenant structures.

c. Scope of Report

This report summarizes available pertinent data relating to the project; presents a summary of visual observations made during the field inspection; presents an assessment of hydrologic and hydraulic conditions at the site; presents an assessment as to the structural adequacy of the various project features; and assesses the general condition of the dam with respect to safety.

Subsurface investigations, laboratory testing, and detailed analyses were not within the scope of this study. The conclusions drawn herein, therefore, are based on the presence of, or absence of, obvious signs of distress. No warranty as to the absolute safety of the project features is implied by the conclusions presented in this report.

It should be noted that reference in this report to left or right abutments is as viewed looking downstream. Where left abutment or left side of the dam is used in this report, this also refers to west abutment or side, and right to the east abutment or side.

d. Evaluation Criteria

Criteria used to evaluate the dam were furnished by the Department of the Army, Office of the Chief of Engineers, in "Recommended Guidelines for Safety Inspection of Dams", Appendix D. These guidelines were developed with the help of several Federal agencies and many State agencies, professional engineering organizations, and private engineers.

1.2 Description of the Project

a. Description of Dam and Appurtenances

The following description is based exclusively on the original design drawings, observations and measurements made during visual inspection. No "as-built" drawings were available during the preparation of this report.

The dam consists of a homogenous earthfill embankment between earthen abutments. The crest is 14 feet wide and 750 feet long as shown on available drawings. Field measurements show the crest length to be 788 feet. The crest elevation, according to the drawings, is 635.0 feet above MSL. From field measurements, the crest elevation was found to be 637.0 feet above MSL. The maximum height of the embankment is 33.5 feet.

The upstream and downstream slopes are 1V to 3H and 1V to 2H, respectively. According to the available drawings, an 8-foot wide berm was constructed on the upstream slope at an elevation of 617.0 feet above MSL.

A cutoff trench, with side slopes of 1V to 1H and a base width of 20 feet, was excavated parallel to the dam axis. According to Mr. Elmer Glosier, one of the owners of the dam, the trench was excavated to the rock foundation.

There are two spillways for the Lost Lake Reservoir. The principal spillway is located 100 feet to the east from the left abutment. The spillway is a 33-inch inside diameter reinforced concrete drop inlet structure which connects to a 24-inch inside diameter reinforced concrete pipe which passes under the embankment. According to the drawings,

the 24-inch reinforced concrete pipe is 148 feet long with a maximum slope of 8.4%. A 28-inch tall by 11-foot long concrete wall was constructed across the center of the drop inlet as an anti-vortex device. The concrete wall was constructed from the outside edge of the drop inlet across the opening of the drop inlet and into the embankment. A metal framework structure over the drop inlet was provided as a trashrack.

The emergency spillway is cut into the left abutment. The spillway is a grass-lined open channel with side slopes of 1V to 4H and a bottom width of 90 feet.

According to the plans, a 1-1/2-inch diameter galvanized steel pipe was provided as a livestock water supply. The intake is a low-water intake. The discharge control is a gate valve located 40 feet from the downstream end of the pipe. The gate valve is housed in a clay pipe.

A 6-inch diameter perforated helical metal pipe was provided in the embankment as an interceptor drain. The outlet of the drain is located 218 feet to the right of the centerline of the outlet to the drop inlet. According to the drawings, the drain was placed parallel to the crest extending 61 feet to the right of the drain outlet and 233 feet to the left of the drain outlet.

b. Location

The Lost Lake Dam is located on the headwaters of Lost Creek, Lincoln County, Missouri. The nearest downstream community is Elsberry, population 1,398, which is approximately 4.5 miles downstream. The dam and reservoir are shown on the Luckett Ridge Quadrangle Sheet (7.5 minute series) in Section 7, Township 50 North, Range 2 East.

c. Size Classification

According to the "Recommended Guidelines for Safety Inspection of Dams", by the U.S. Department of the Army, Office of the Chief Engineer, the dam is classified in the dam size category as being "Small" since its storage is less than 1,000 acre-feet. The dam is also classified as "Small" in dam height category because its height is less than 40 feet. The overall size classification is, accordingly, "Small" in size.

d. Hazard Classification

The dam has been classified as having "High" hazard potential in the National Inventory of Dams, on the basis that in the event of failure of the dam or its appurtenances, excessive damage could occur to downstream property, together with the possibility of the loss of life. Our findings concur with the classification. Within the estimated damage zone, which extends approximately 3.5 miles downstream of the dam, are three dwellings, two buildings, and a quarry and plant. The town of Elsberry is approximately 4.5 miles downstream.

e. Ownership

The Lost Lake Dam is owned privately by the Glosier Brothers. The mailing address is The Glosier Brothers, c/o Elmer Glosier, #5 Briarwood Lane, St. Charles, Missouri, 63301.

f. Purpose of Dam

The purpose of the dam is for flood control.

g. Design and Construction History

The available records show that the dam was designed in April 1955, by the Department of Agriculture, Soil Conservation Service as part of the Lost Creek Watershed Protection Project. The design engineer's name, as listed on the plans, is Mr. Browning. The dam was built in 1955-56 by Ray & Briscoe, a local construction company.

h. Normal Operational Procedures

Normal procedure is to allow the flood control reservoir to remain as full as possible with the water level being controlled by rainfall, runoff, evaporation and the elevation of the spillway crest.

1.3 Pertinent Data*

a. Drainage Area (square miles):	1.06
b. Discharge at Damsite	
Estimated experienced maximum flood (cfs):	60
Estimated ungated spillway capacity at maximum pool elevation (cfs):	5495
c. Elevation (Feet above MSL)	
Top of dam:	637
Spillway crest:	
Principal Spillway	617
Emergency Spillway	630.75
Normal Pool	617
Maximum Pool(PMF):	637.69
d. Reservoir	
Length of maximum pool (Feet):	2800
e. Storage (Acre-Feet)	
Top of dam:	669
Spillway crest:	
Principal Spillway	72
Emergency Spillway	414
Normal Pool:	72
Maximum Pool (PMF):	702
f. Reservoir Surface (Acres)	
Top of dam:	46
Spillway crest:	
Principal Spillway	15
Emergency Spillway	36

Normal Pool:	15
Maximum Pool(PMF):	46.5

g. Dam

Type:	Earthfill
Length:	788 feet
Structural Height:	33.5 feet
Hydraulic Height:	33.5 feet
Top width:	14.0 feet
Side slopes:	
Downstream	1V to 2H
Upstream	1V to 3H
Zoning:	Homogeneous
Impervious core:	NA
Cutoff:	Cutoff trench with 20-foot bottom width and 1V to 1H side slopes.
Grout curtain:	Unknown

h. Diversion and Regulating Tunnel — None

i. Spillway

Type:		
Principal Spillway	Drop Inlet, Uncontrolled	
Emergency Spillway	Open Channel, Uncontrolled	
Length of weir:		
Principal Spillway	12.3 feet (Drop inlet spillway)	
Emergency Spillway	90 feet	
Crest Elevation (feet above MSL):		
Principal Spillway		617.0
Emergency Spillway		630.75

j. Regulating Outlets

Type:	1 1/2-inch diameter galvanized steel pipe livestock water supply
Length:	204 feet (According to Plans)
Closure:	Gate valve at downstream end
Maximum Capacity:	Unknown

* The term "maximum pool", as used in this section, refers to pool level at top of dam elevation unless otherwise specified.

SECTION 2 : ENGINEERING DATA

2.1 Design

Design drawings are available from the Department of Agriculture, Soil Conservation Service, and are included as part of this report. The drawings were prepared in April of 1955 by the Department of Agriculture, Soil Conservation Service. No specifications, engineering computations or soil data for this project were available. No "As-Built" drawings were available during the preparation of this report.

2.2 Construction

No data is available concerning the construction of the dam and appurtenant structures, other than the construction history given in Section 1.2g.

2.3 Operation

No operation records are available for the Lost Lake Dam.

2.4 Evaluation

a. Availability

The availability of engineering data is poor and consists only of the design drawings mentioned in Section 2.1, State Geological Maps and U.S.G.S. Quadrangle Sheets. "As-built" drawings, geologic and soil mechanics reports for this dam can be obtained from the Department of Agriculture, Soil Conservation Service. However, they were not available during the preparation of this report. No information on design hydrology, or hydraulic design was available, nor were seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams", which is considered a deficiency.

b. Adequacy

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. The data available is inadequate to evaluate the hydraulic and hydrologic capabilities of the dam. In the absence of seepage and stability analyses no quantitative evaluation of the structural stability can be made.

c. Validity

Only a set of design drawings was available for review. From field measurements, the dam appears to have been constructed according to the available drawings, except for the discrepancies described in Section 1.2a. Lost Lake Dam was originally Flood Detention Structure No. 1 according to the design drawings provided by the Soil Conservation Service.

SECTION 3: VISUAL INSPECTION

3.1 Findings

a. General

A visual inspection of the Lost Lake Dam was made on June 15, 1979. The following persons were present during the inspection:

Name	Affiliation	Disciplines
David J. Kerkes	Engineering Consultants, Inc.	Soils
Peter Howard	Engineering Consultants, Inc.	Geology
Mark R. Haynes	Engineering Consultants, Inc.	Civil, Structural and Mechanical
Kenneth L. Bullard	Engineering Consultants, Inc.	Hydraulics and Hydrology
Kevin Blume	Consoer, Townsend & Assoc., Ltd.	Civil and Structural
Elmer Glosier	Owner	
Robert Glosier	Owner	

Specific observations are discussed below.

b. Dam

The crest of the dam is well protected against surface erosion by a well maintained cover of grass. There was no evidence of significant settlement or cracking on the crest. No significant deviations in horizontal or vertical alignment were apparent. According to Mr. Robert Glosier, the water level has never been higher than 8 feet up the slope above the principal spillway. Therefore, the emergency spillway has not been used and the dam has not been overtopped.

The upstream slope had no evidence of riprap protection. Some minor erosion has occurred on the slope near the water surface due to wave action. According to Mr. Robert Glosier, the Glosier Brothers have tried to stop the erosion from doing further damage to the slope by planting canary reed grass along the shoreline. The slope appeared to be well maintained. No depressions or settlements were apparent on the slope.

The downstream slope of the embankment has a heavy grass cover. According to Mr. Elmer Glosier, a slide on the slope occurred shortly after construction. The slide area is located on the upper half of the slope and immediately to the right of the principal spillway outlet. The damaged area was approximately 20 to 25 feet wide and did not extend to the crest. The slide was shallow in depth. Some minor erosion was observed on the downstream embankment near the fence on the left abutment. No other depressions, bulges or settlements were apparent on the downstream slope. No seepage was apparent along the toe of the slope. Materials removed

immediately below the vegetation cover on the embankment appeared to be a clayey silt. The interceptor drain outlet was covered and the drain has not discharged to the best of Mr. Elmer Glosiers' knowledge.

According to the "Missouri General Soil Map and Soil Association Descriptions" published by the Soil Conservation Service, the materials in the general area of the dam are classified as a Lindley silt loam of the Central Mississippi Valley Wooded Slopes family. The Lindley silt may be susceptible to excessive erosion. If the Lindley silt was used in the embankment, the embankment may be susceptible to erosion and failure should overtopping result during a flood.

There are no signs of rodent activity in either the embankment or the abutments, but there is some muskrat activity in the reservoir area. According to Mr. Robert Glosier, the muskrats are trapped annually.

c. *Project Geology*

The dam is situated in the Dissect Till Plains Section of the Central Lowlands Province (Fenneman, N.M., "Physiography of Eastern United States", 1946). In the area of the dam site, however, much of the till has been removed by erosion. The entire area exhibits a karst topography with frequent sink holes.

The rocks in the area dip regionally to the northeast off the Ozark uplift to the south. Rocks ranging in age from Ordivician to Pennsylvanian occur in the general area.

At the dam site, limestones of the Plattin Formation (Ordivician)(Geologic Map of Missouri, 1979) occur. The rocks outcropping near the downstream toe consist of light gray, crystalline, dense limestone. The rock is massive and often forms escarpments of five feet or more. Higher stratigraphically, at about the elevation of the dam, a dense, gray sub-lithographic limestone crops out. No dip could be measured in the beds in the vicinity of the dam. The entire area exhibits a karst topography with frequent sink holes.

d. Appurtenant Structures

(1) Spillways

The concrete drop inlet structure is in good condition. No spalling or cracking of the concrete was observed. The trashrack was in good condition and unplugged. The concrete anti-vortex device was also in good condition with no spalling or cracking of the concrete observed. Leakage in the 24-inch diameter concrete pipe was detected. The leakage appeared to be in the drop inlet structure because the upstream invert of the structure had standing water in it. A flow of less than 1 gpm was observed at the outlet of the conduit. No spalling or cracking of the concrete in the conduit was observed. The joints of the exposed portion of the conduit showed no sign of misalignment. The area around the intake to the principal spillway was overgrown with tall grass.

The emergency spillway was heavily covered with grass. The emergency spillway channel was not obstructed. No indication of instability in the slopes was apparent. However, the slope on the left side of the spillway is being eroded by grazing cattle.

(2) Outlet Works

No regulated outlet works were provided for the Lost Lake Dam except for a livestock watering system. The inlet and outlet of the system were not located. The gate valve clay pipe housing was located at the toe of the downstream slope approximately 200 feet to the right of the principal spillway outlet. The gate valve was accessible, however, according to Mr. Elmer Glosier, the system is no longer used.

e. Reservoir Area

The water surface elevation was 616.8 feet above MSL on the day of the inspection.

The reservoir rim is gently sloped and no indication of instability or severe erosion were readily apparent. The slopes above the reservoir are heavily grassed. A few houses are built around the reservoir rim.

f. Downstream Channel

The downstream channel of the principal spillway is a well-defined, narrow rock lined channel. The channel was not obstructed. The channel extends for a few hundred feet downstream and then flows into an open grassy pasture.

The downstream channel of the emergency spillway is a well-defined, grass lined channel which was not obstructed. The channel is approximately 220 feet long and then it flows into an open grassy pasture.

3.2 Evaluation

The visual inspection did not reveal any items which are sufficiently significant to indicate a need for immediate remedial action.

The following conditions were observed which could affect the safety of the dam or which will require maintenance within a reasonable period of time.

1. Minor erosion of the upstream slope near the water surface.

2. Eroded area on the embankment near the left abutment.

3. The tall grass around the intake to the principal spillway.

SECTION 4: OPERATIONAL PROCEDURES

4.1 Procedures

Lost Lake Dam was built to impound water for flood control as part of the Lost Creek Watershed Protection Project. The only operating facility is a livestock watering system which, according to Mr. Elmer Glosier, is no longer used. The water level is controlled by rainfall, runoff, evaporation and the spillway crest elevation.

4.2 Maintenance of Dam

The dam is maintained by the owners, the Glosier Brothers. The maintenance of the dam appears to be adequate. The upstream slope and the crest are mowed semiannually, however, due to the steepness of the downstream slope, the downstream slope is not mowed. Trees and bushes are kept off of the embankment. There have not been any major repairs done to the dam itself since its original construction.

4.3 Maintenance of Operating Facilities

The only operational facility at the damsite is the livestock watering system. The livestock watering system is no longer used.

4.4 Description of Any Warning System in Effect

The inspection team was not informed of any warning system in effect for this dam.

4.5 Evaluation

The maintenance for Lost Lake Dam seems to be adequate, however, the remedial measures as described in Section 7 should be undertaken.

SECTION 5: HYDRAULIC/HYDROLOGIC

5.1 Evaluation of Features

a. Design

The watershed area of the Lost Lake Dam upstream from the dam axis consists of approximately 676 acres. Most of the watershed area is wooded and covered with grass. Land gradients in the higher regions of the watershed average roughly 12 percent, and in the lower areas surrounding the reservoir average about 6 percent. The Lost Lake Dam is located on the Lost Creek about 1.3 miles downstream of the extreme headwaters of the creek. At its longest arm the watershed is approximately 1.3 miles long. A drainage map showing the watershed area is presented as Plate 1 in Appendix B.

Evaluation of the hydraulic and hydrologic features of Lost Lake Dam was based on criteria set forth in the Corps of Engineers' "Recommended Guidelines for Safety Inspection of Dams", and additional guidance provided by the St. Louis District of the Corps of Engineers. The Probable Maximum Flood (PMF) was calculated from the Probable Maximum Precipitation (PMP) using the methods outlined in the U.S. Weather Bureau Publication, Hydrometeorological Report No. 33. The probable maximum storm duration was set at 24 hours, and storm rainfall distribution was based on criteria given in EM 1110-2-1411 (Standard Project Storm). The SCS method was used for deriving the unit hydrograph, utilizing the Corps of Engineers' computer program HEC-1 (Dam Safety Version). The unit

hydrograph parameters are presented in Appendix B. The SCS method was also used for determining loss rate. The hydrologic soil group of the watershed was determined by use of published soil maps. The hydrologic soil group of the watershed and the SCS curve number are also presented in Appendix B. The curve number, unit hydrograph parameters, PMP index rainfall and the percentages for various durations were directly input to the HEC-1 (Dam Safety Version) computer program to obtain the PMF hydrograph. The computed peak discharge of the PMF and one-half of the PMF are 10,568 cfs and 5,284 cfs, respectively.

Both the PMF and one-half of the PMF inflow hydrographs were routed through the reservoir by the Modified Puls Method also utilizing the HEC-1 (Dam Safety Version) computer program. The reservoir level was assumed at the principal spillway crest level at the start of the routing computation. The peak outflow discharges for the PMF and one-half of the PMF are 7,620 and 1,993 cfs, respectively. Only the PMF, when routed through the reservoir, results in overtopping of the dam.

The stage-outflow relation for the spillway was prepared from field notes and sketches prepared during the field inspection and limited design drawings. The reservoir stage-capacity data was based on the U.S.G.S. Luckett Ridge, Missouri Quadrangle topographic map (7.5 minute series). The spillway and overtop rating curve and the reservoir capacity curve are presented in Plates 2 & 3, respectively, in Appendix B.

From the standpoint of dam safety, the hydrologic design of a dam aims at avoiding overtopping. Overtopping is especially dangerous for an earth dam because the downrush of waters over the crest can erode the dam embankment and release all the stored water suddenly into the downstream floodplain. The safe hydrologic design of a dam requires a spillway crest height that can handle a very large and exceedingly rare flood without overtopping.

The Corps of Engineers designs its dams to safely pass the Probable Maximum Flood that is estimated could be generated from the upstream watershed. This is the generally accepted criterion for major dams throughout the world, and is the standard for dam safety where overtopping would pose any threat to human life. According to the Corps' criteria, the hydrologic requirement for safety for this dam is the capability to pass from one-half of the Probable Maximum Flood to the Probable Maximum Flood without overtopping.

b. Experience Data

No records of reservoir stage or spillway discharge are maintained for this site. Nevertheless, according to the owners, the maximum reservoir level was about 8 feet up the slope above the crest of the principal spillway.

c. Visual Observations

Observations made of the spillway during the visual inspecton are discussed in Section 3.1c(1) and evaluated in Section 3.2.

d. Overtopping Potential

As indicated in Section 5.1-a, only the Probable Maximum Flood, when routed through the reservoir, results in overtopping of the dam. The PMF overtopped the dam crest by 0.69 feet. The spillway/reservoir system can accomodate one-half of the PMF with a freeboard of 2.88 feet. The total duration of embankment overflow is 0.42 hours during the PMF. The spillway and the reservoir of Lost Lake Dam are capable of accomodating a flood equal to approximately 81 percent of the PMF just before overtopping the dam. The 100-year flood is equal to approximately 15 percent of the PMF. The spillway/reservoir system will accomodate the 100-year flood without overtopping the dam.

The failure of the dam could cause extensive damage to the property downstream of the dam and possible loss of life. Within 3.1 miles downstream of the dam are three dwellings, two buildings and a quarry and plant. The town of Elsberry lies about 4.5 miles downstream.

SECTION 6: STRUCTURAL STABILITY

6.1 Evaluation of Structural Stability

a. Visual Observations

There were no signs of settlement or distress observed on the embankment or foundation during the visual inspection. The slide area on the downstream slope appears to be stable and is not serious enough to indicate an unsafe condition. According to Mr. Elmer Glosier, a professional engineer viewed the slide area shortly after the slide occurred. The professional engineer determined that the damaged area had no significant effect on the overall stability of the slope and that the slope had stabilized. According to Mr. Elmer Glosier, no other slides have occurred on the slope.

The minor erosion of the upstream slope due to wave action was not serious enough to constitute an unsafe condition. According to Mr. Robert Glosier, canary reed grass has been planted along the shoreline to prevent further erosion of the slope. Nevertheless, the erosion should be monitored and if the erosion continues, steps should be taken to control the problem.

Neither the principal spillway drop inlet nor the 24-inch reinforced concrete discharge pipe exhibited any evidence of misalignment or structural instability. The seepage observed at the outlet of the pipe is felt to have no significant effect on the structural stability of the dam. Nevertheless, the seepage should be monitored and any changes

in quantity or color should be reported and investigated.

The eroded area on the embankment near the left abutment was not serious enough to constitute an unsafe condition. The erosion of the left side slope of the emergency spillway does not constitute an unsafe condition because if the erosion is allowed to continue it will just erode into the natural ground. This condition will not decrease the emergency spillway discharge capacity or affect the stability of the side slopes of the spillway. Also, this condition will not cause any instability in the dam embankment.

b. Design and Construction Data

No design computations were uncovered during the report preparation phase. Seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams" was not available. No embankment or foundation soil parameters are available for carrying out a conventional stability analysis on the embankment. No construction data or specifications relating to the degree of embankment compaction are available for use in a stability analysis.

c. Operating Records

No operating records are available relating to the stability of the dam or appurtenant structures. The water level on the day of inspection was near the crest of the principal spillway, and it is assumed that the reservoir remains close to full at all times. No regulated outlet works exists at the damsite except for the livestock watering system. The system is no longer used.

d. Post Construction Changes

No post construction changes exist which will affect the structural stability of the dam.

e. Seismic Stability

The dam is located in seismic Zone 1, as defined in "Recommended Guidelines for Safety Inspection of Dams" as prepared by the Corps of Engineers, and therefore, does not require a seismic stability analysis.

SECTION 7: ASSESSMENT/REMEDIAL MEASURES

7.1 Dam Assessment

The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

It should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is also important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through continued care and inspection can there be any chance that an unsafe condition could be detected.

a. Safety

The spillway capacity of the Lost Lake Dam was found to be "Inadequate". The spillway/reservoir system will accomodate 81 percent of the PMF without overtopping the dam. The spillway and the reservoir will accomodate the 100-year flood without overtopping the dam.

The dam embankment appears to be in satisfactory structural condition. The minor erosion due to wave action on the upstream embankment slope is not serious at this time, however, the condition should be monitored and repaired as required.

The slide area on the downstream embankment slope has stabilized and was determined by a professional engineer to pose no danger to the stability of the downstream slope. No other signs of distress were observed in the embankment or in the foundation, nor was seepage observed at any location. No seepage and stability analyses were available for review.

The tall grass around the intake to the principal spillway should be cleared and not allowed to grow back. This condition poses an obstacle to the normal operation of the principal spillway. The seepage through the conduit of the principal spillway does not jeopardize the safety of the embankment in its present condition, but it should be monitored for any changes in quantity and color.

The erosion of the left side slope of the emergency spillway does not jeopardize the safety of the embankment in its present location. The erosion of the embankment near the left abutment does not pose any danger to the safety of the embankment in its present condition, but if allowed to continue to erode the embankment it could jeopardize the safety of the embankment.

The muskrat activity in the reservoir area poses no danger to the embankment, but they should be watched and not allowed to burrow into the embankment.

The Plattin Formation is relatively competent and is a suitable foundation for the dam. While the possibility exists that leakage through solution channels could occur in such a limestone formation, it is evident that none occurs at this site at this time or that they were sufficiently blanketed during construction.

b. Adequacy of Information

The conclusions presented in this report are based on field measurements, the available engineering data, past performance and present condition of the dam. Information on the design hydrology, hydraulic design, and the operation and maintenance of the dam as well as seepage and stability analyses were not available. To supplement available data and allow for a more definite evaluation of the dam, it is recommended that the following programs be initiated:

1. Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams should be made and this inspection report made a matter of record.

2. Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

3. Perform seepage and stability analyses comparable to the requirements of the "Recommended Guidelines for Safety Inspection of Dams".

c. Urgency

The remedial measures recommended in paragraph 7.2 should be accomplished within a reasonable period of time.

d. Necessity for Phase II Inspection

Based on results of the Phase I inspection, a Phase II inspection is not felt to be necessary.

7.2 Remedial Measures

Alternatives:

1. Spillway capacity and/or height of the dam should be increased to accomodate the PMF without overtopping the dam. The overtopping depth during the occurence of the PMF, stated elsewhere in the report is not the required or recommended increase in height of the the dam.

O & M Procedures:

1. The following corrective measures should be undertaken within a reasonable period of time.

(a) Remove tall grass from around intake to the principal spillway and keep the grass from growing back.

(b) Repair eroded area on the embankment near the crest at the left abutment and protect the area from further damage.

(c) Seepage and stability analyses should be performed by a professional engineer experienced in the design and construction of dams.

2. The following conditions should be monitored.

(a) Monitor erosion due to wave action on upstream slope, and if the erosion continues, other protective measures should be employed to protect the slope from further damage.

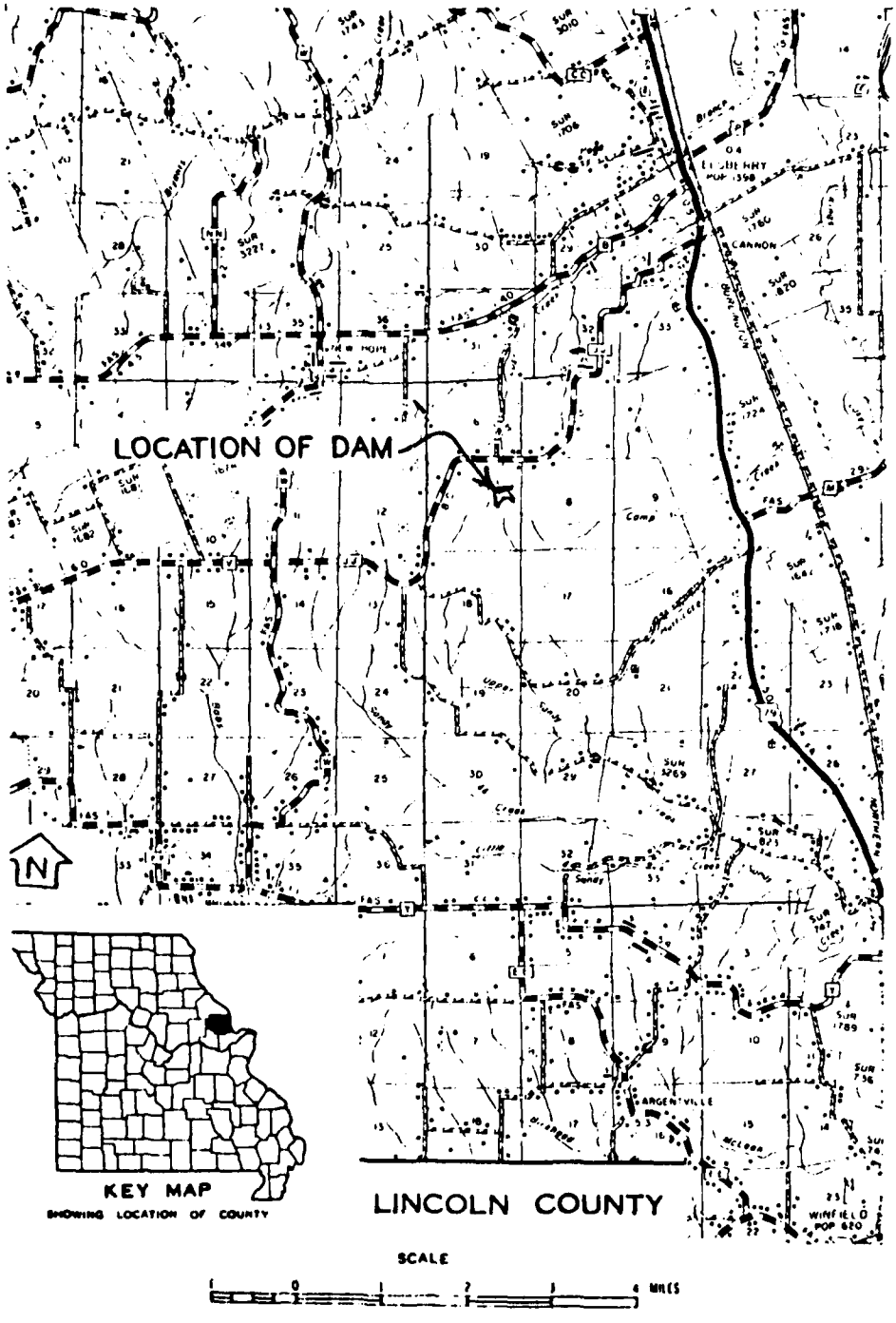
(b) Monitor the seepage through the outlet conduit for changes in quantity or color and report any change.

3. The owner should initiate the following programs:

(a) Periodic inspection of the dam by a professional engineer experienced in the design and construction of earthen dams.

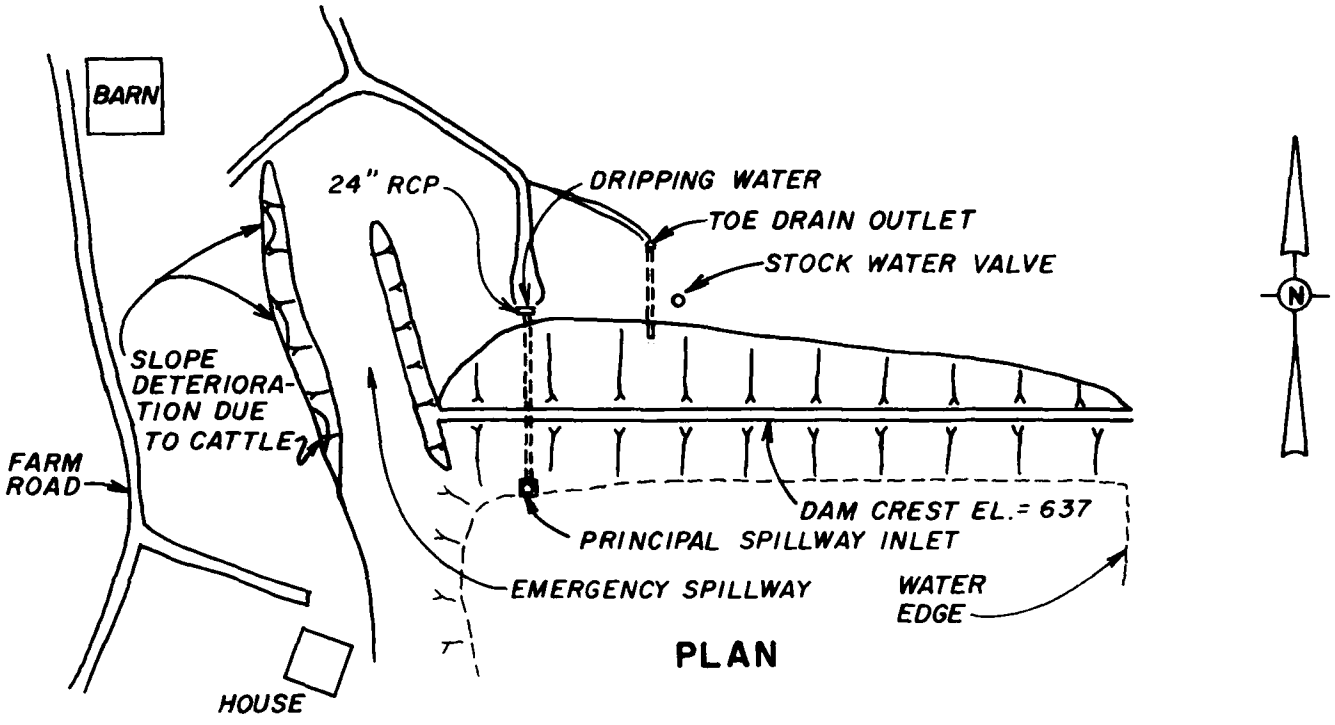
(b) Set up a maintenance schedule and log all visits to the dam for operation, repairs and maintenance.

PLATES

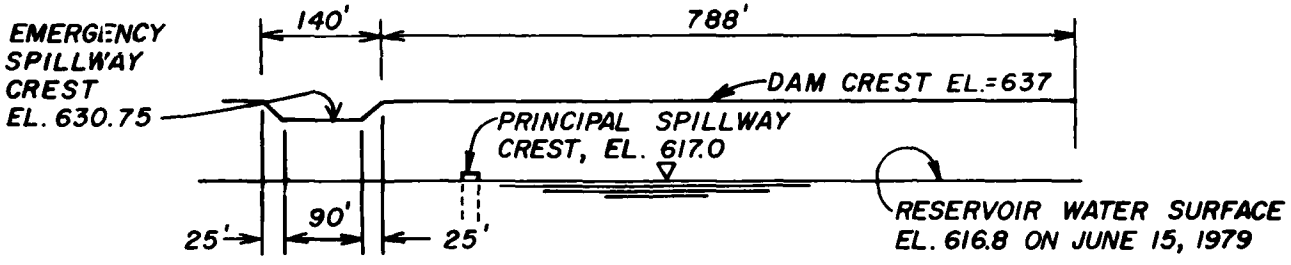


LOCATION MAP-LOST LAKE DAM

LOST LAKE DAM (MO. 10212)
PLAN & ELEVATION



PLAN



ELEVATION

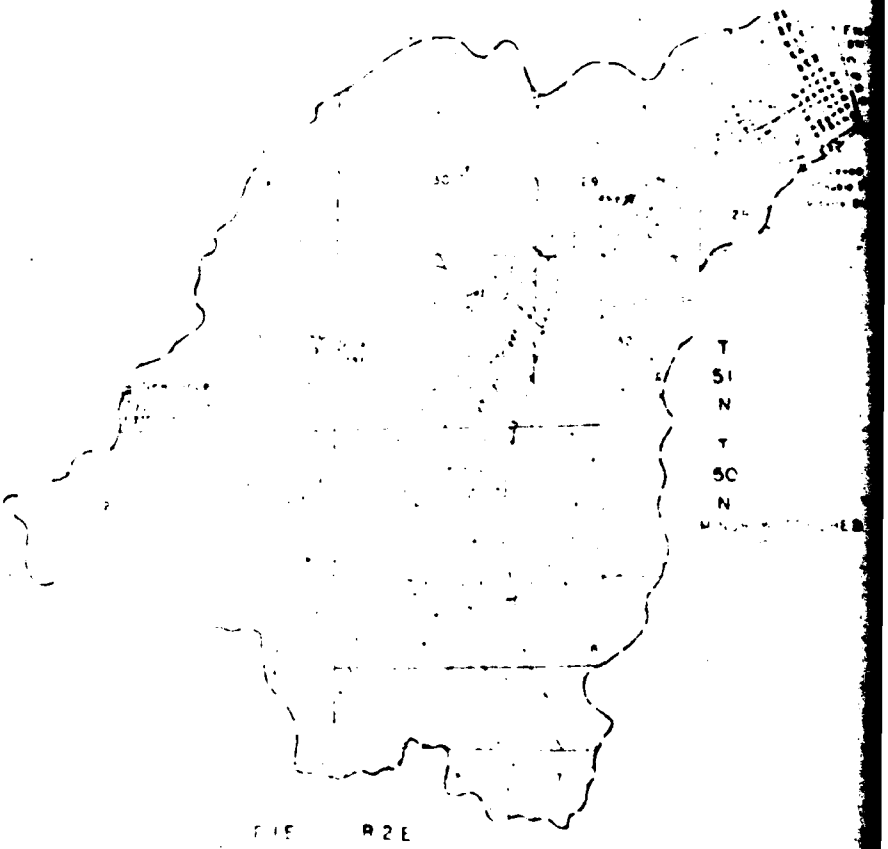
SCALE
1"= 200' (HORIZONTAL)
VERTICAL (NOT TO SCALE)

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

DETAIL PLANS FOR
LOST CREEK WATERSHED PROTECTION PROJ

THE SOIL DISTRICT OF LINCOLN COUNTY, MISSOURI

PART I OF
MINOR WATERSHED "E"



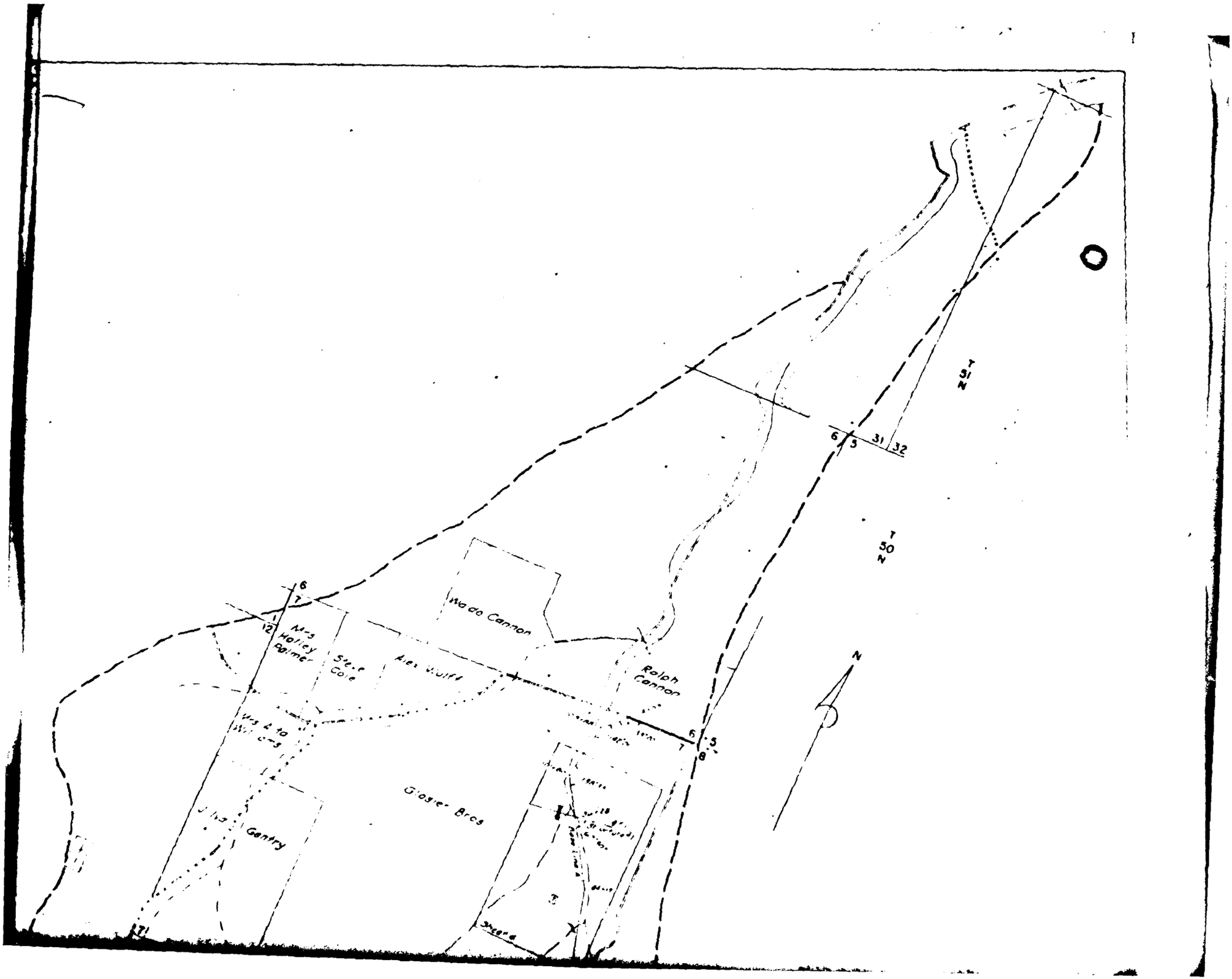
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

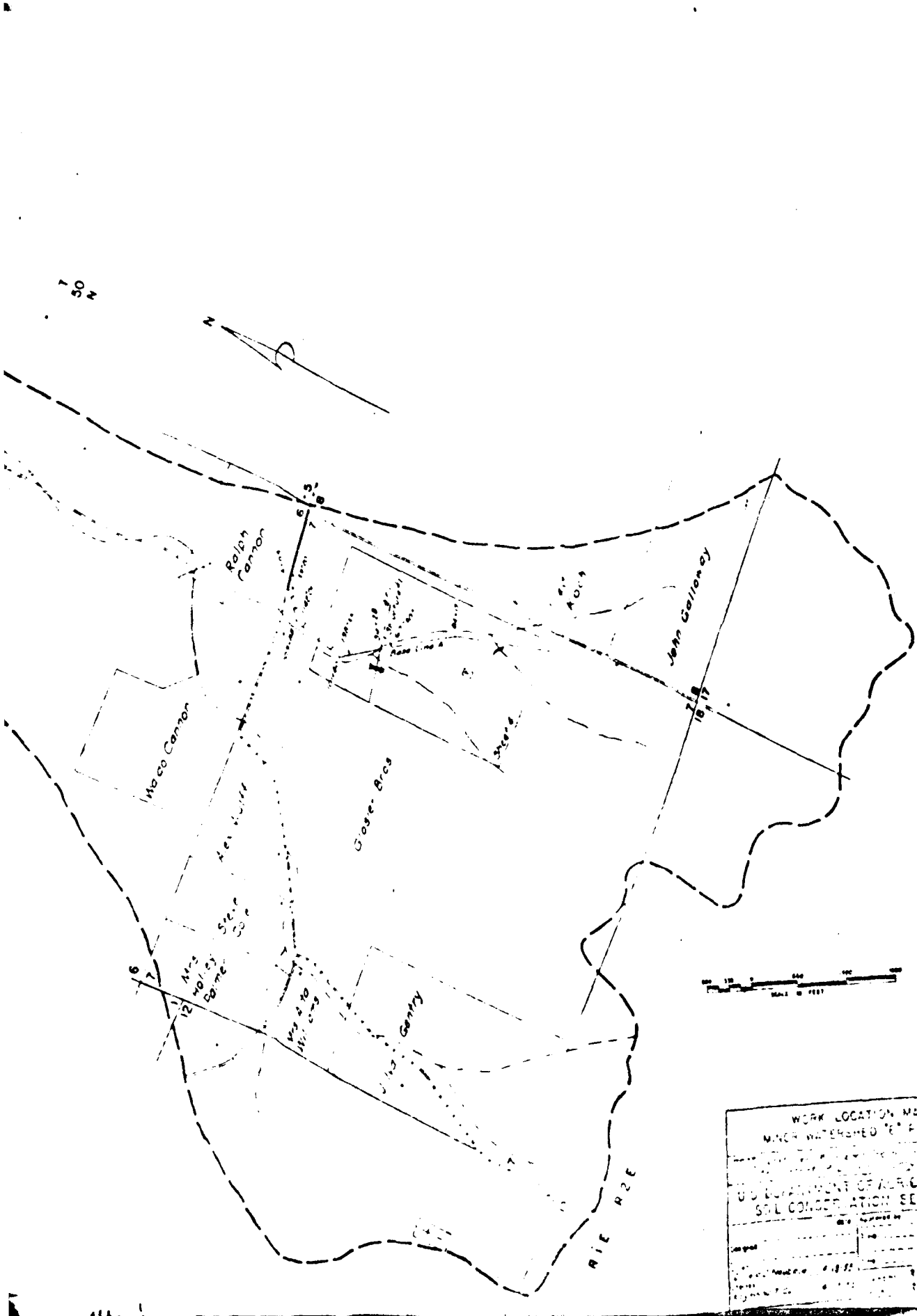
DETAIL PLANS FOR

ST CREEK WATERSHED PROTECTION PROJECT

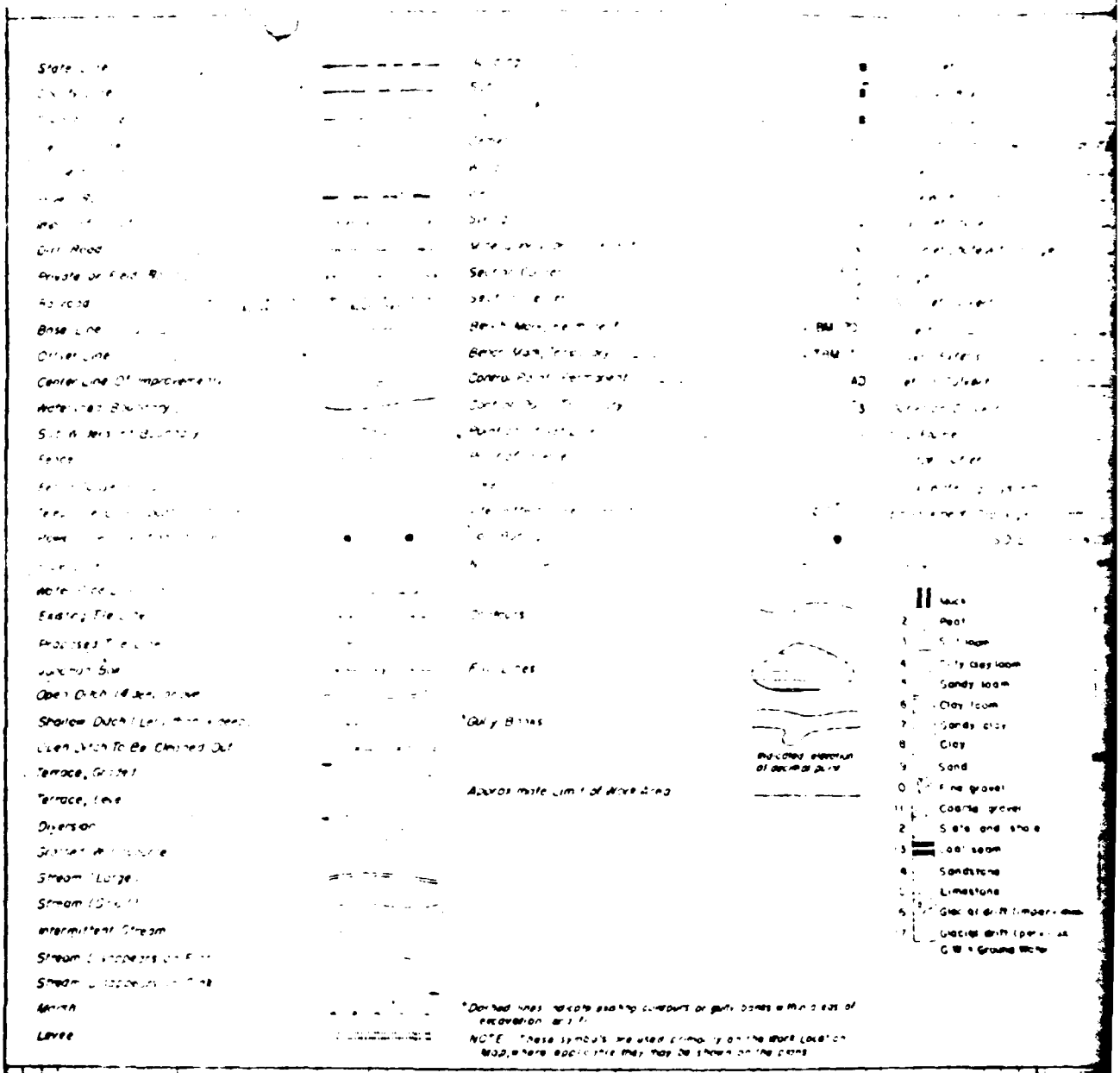
THE SOIL CONSERVATION DISTRICT OF LINCOLN COUNTY, MISSOURI

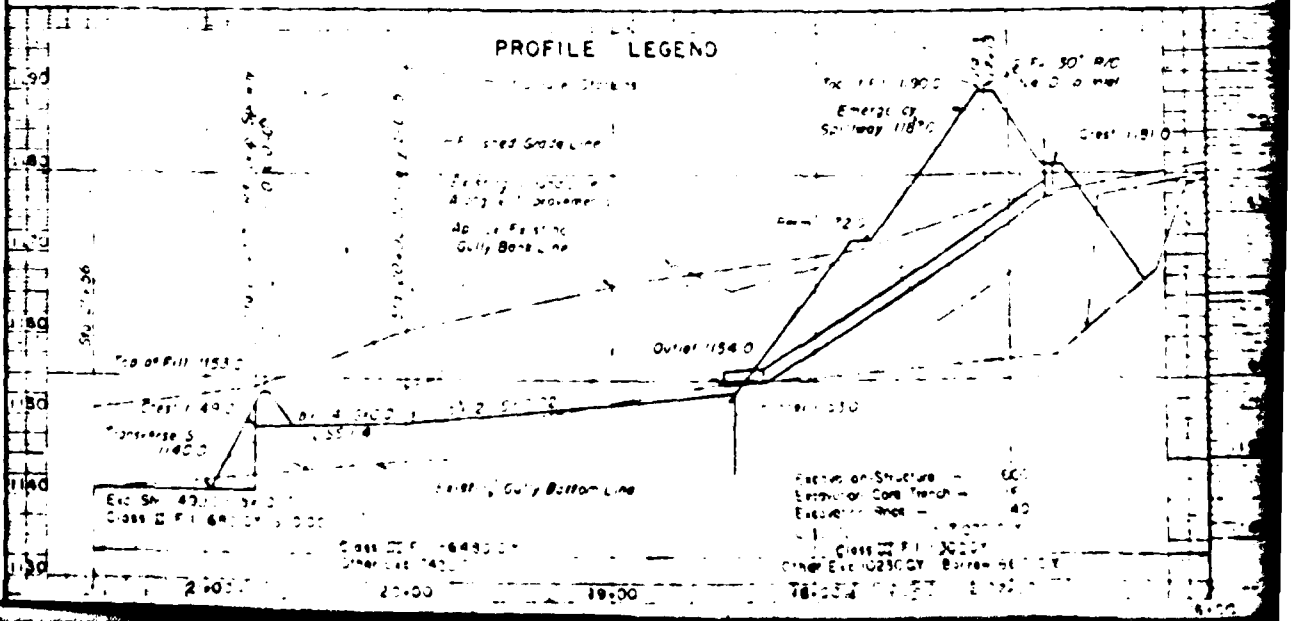
PART I OF
MINOR WATERSHED "E"


T 31 N
T 30 N
6
31
32
5
Wade Cannon
Mrs Holley Palmer
Steve Cole
Alex Wolff
Ralph Cannon
Gantry
Glover Bros
N


T 30 N
N
Ralph Connor
Waco Connor
Geiger Bros
John Galloway
Gentry
R1E R2E
WORK LOCATION MAP
MINOR WATERSHED "E" PART I
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

2


Rock
Peat
Muck
Silty clay loam
Sandy loam
Clay loam
Sandy clay
Clay
Sand
Fine gravel
Coarse gravel
Slate and shale
Coal seam
Sandstone
Limestone
Glacial drift (permeable)
Glacial drift (impermeable)
Ground Water
Drilled elevation of decomposed rock
Approximate limit of drilled area
*Drilled holes to locate existing culverts or gully banks within limits of excavation only.
NOTE These symbols are used primarily on the Work Location Map, where applicable they may be shown on the plans


PROFILE LEGEND
Emergency Spillway 1180
Crest 1181.0
Top of Fill 1153.0
Outlet 1154.0
Crest 1149.0
Transverse S 1160.0
Gully Bottom Line
Class III Fill 6400 CY
Class III Fill 3000 CY
20+00
19+00

DIVERSIONS & EMERGENCY SPILLWAYS

DEFINITIONS OF TERMS

S - grade of channel in feet of drop per foot of length
B - Bottom width of channel in feet
Z - side slope of channel, horizontal to 1 vertical
T - top width of channel, horizontal in feet
FH - freeboard in feet, vertical distance between design high water line and top of channel

TABLE OF STANDARD DIVERSIONS

Improvement	Z	SS
Improved Diversions		3:1
Diversions	6	3:1
Levees	6	3:1 or As shown on plans
Drop Inlet Embankments	10	3:1 or As shown on plans
Chute Embankments	6	3:1
Drop Spillway Embankments	6	3:1 upstream - 2:1 downstream

Note 1 Use standard dimensions unless otherwise shown on plans
2 Use s, b, and FH as shown on plans

GENERAL NOTES

All improvements are along Base Line unless otherwise indicated
Elevations of pipes refer to invert elevations
Cross sections shown as looking downstream
Lines showing limits of structure excavation are on a 1:1 slope unless otherwise indicated

Locate existing structures or gas lines within limits of work if possible
Symbols are used extensively on the plans. Location of some may be shown on the plans

Using Mechanical Analysis
% % % %
(gravel sand silt clay)

10 - 18 - 76 - 6
10 - 28 - 64 - 8
10 - 20 - 66 - 14

Method No 2

Using a letter the dominant name or symbol is derived from the soil type

1 Muck
2 Peat
3 Silt loam
4 Silty clay loam
5 Sandy loam
6 Clay loam
7 Sandy clay
8 Clay
9 Sand
10 Fine gravel
11 Coarse gravel
12 Slate and shale
13 Coal seam
14 Sandstone
15 Limestone
16 Glacial drift (impervious)
17 Glacial drift (pervious)
GW = Ground Water

Indicated extension of decimal point

Limit of drive sheeting

LEGEND

Emergency Spillway Flow
Crest 1191.0
Base 92
Bottom 1154.0
Excavation Structure -
Excavation Core Trench -
Excavation Rock -
Class of Fill
Other Excavation
Borrow Excavation

CROSS SECTION LEGEND

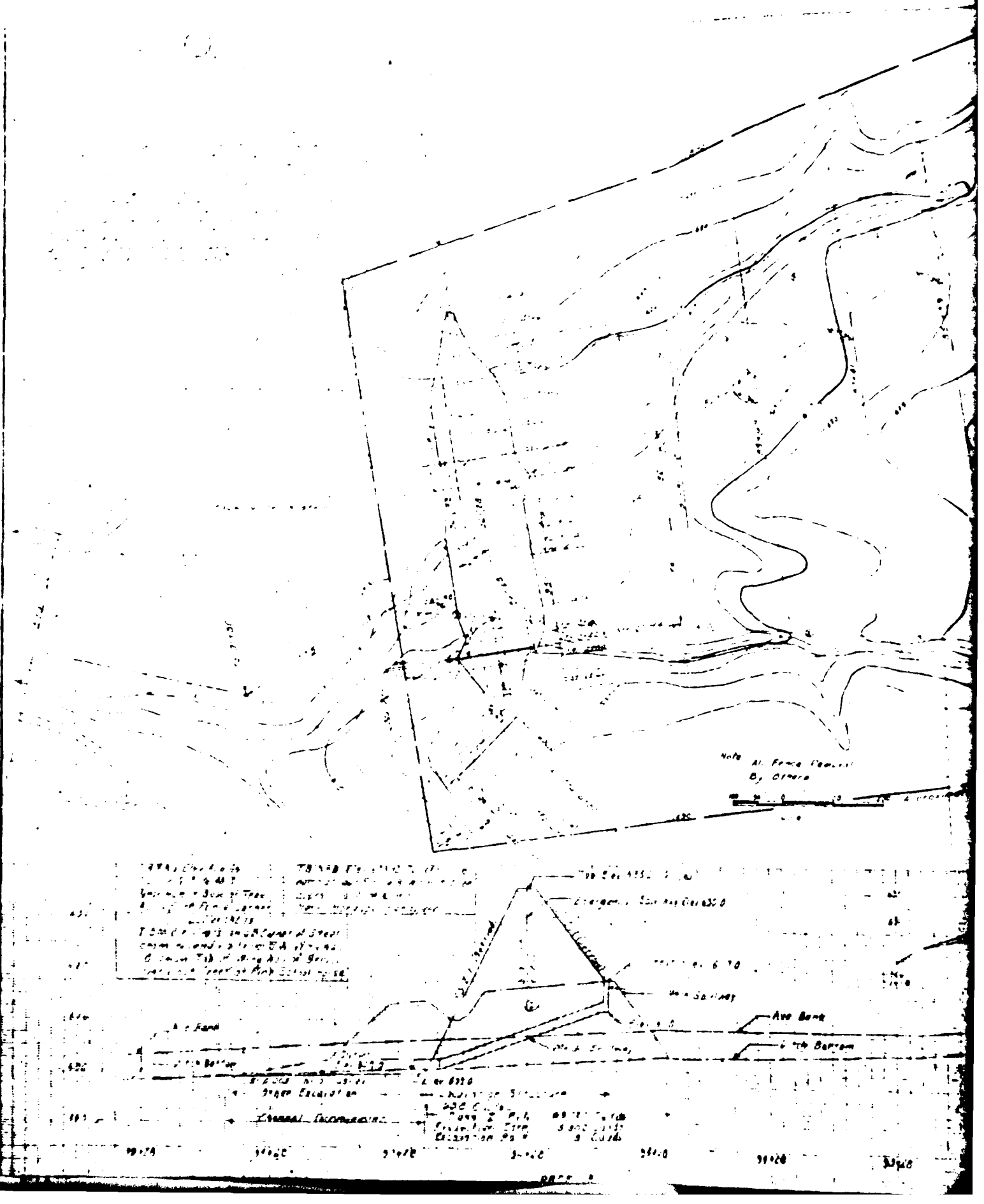
Finished Grade Line
1178.0
Existing ground Line
Structure
Other Excavation
Boring No. 4
Distance from Base Line -
Sta 17+78
Existing Ground Line
Finished Grade Elevation
Other Excavation
Sta 19+80

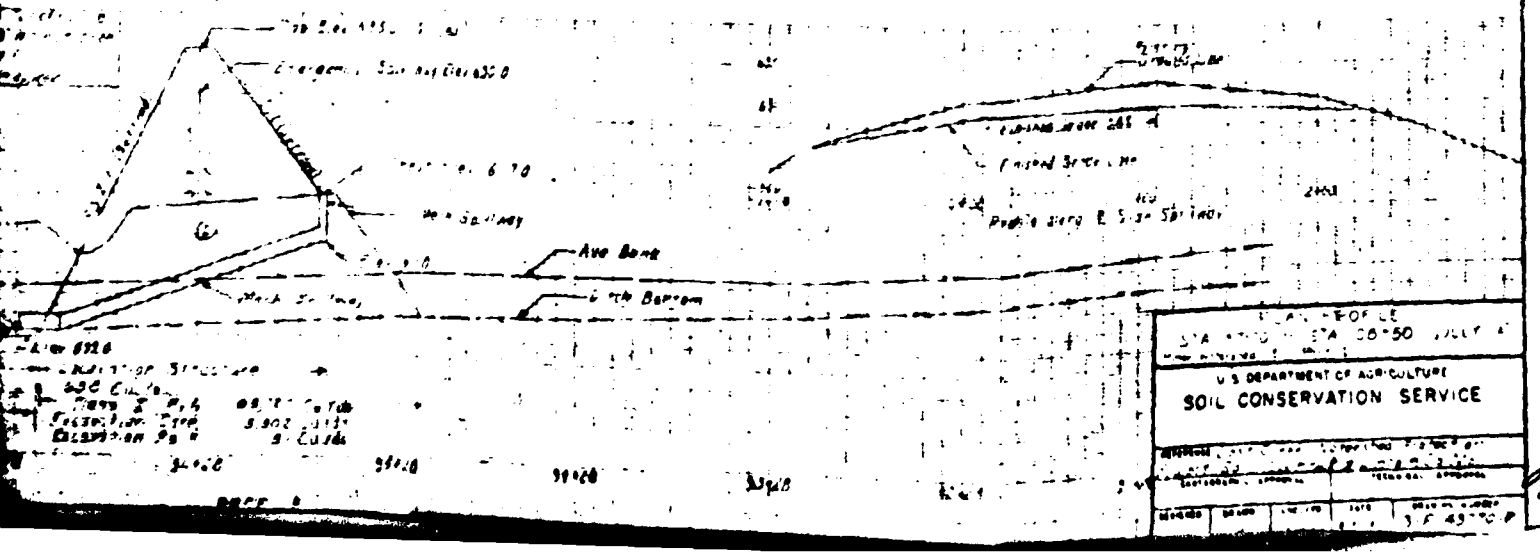
EARTHWORK SYMBOL
Class of Fill
Excavation-Structure
Excavation-Core Trench
Excavation-Rock

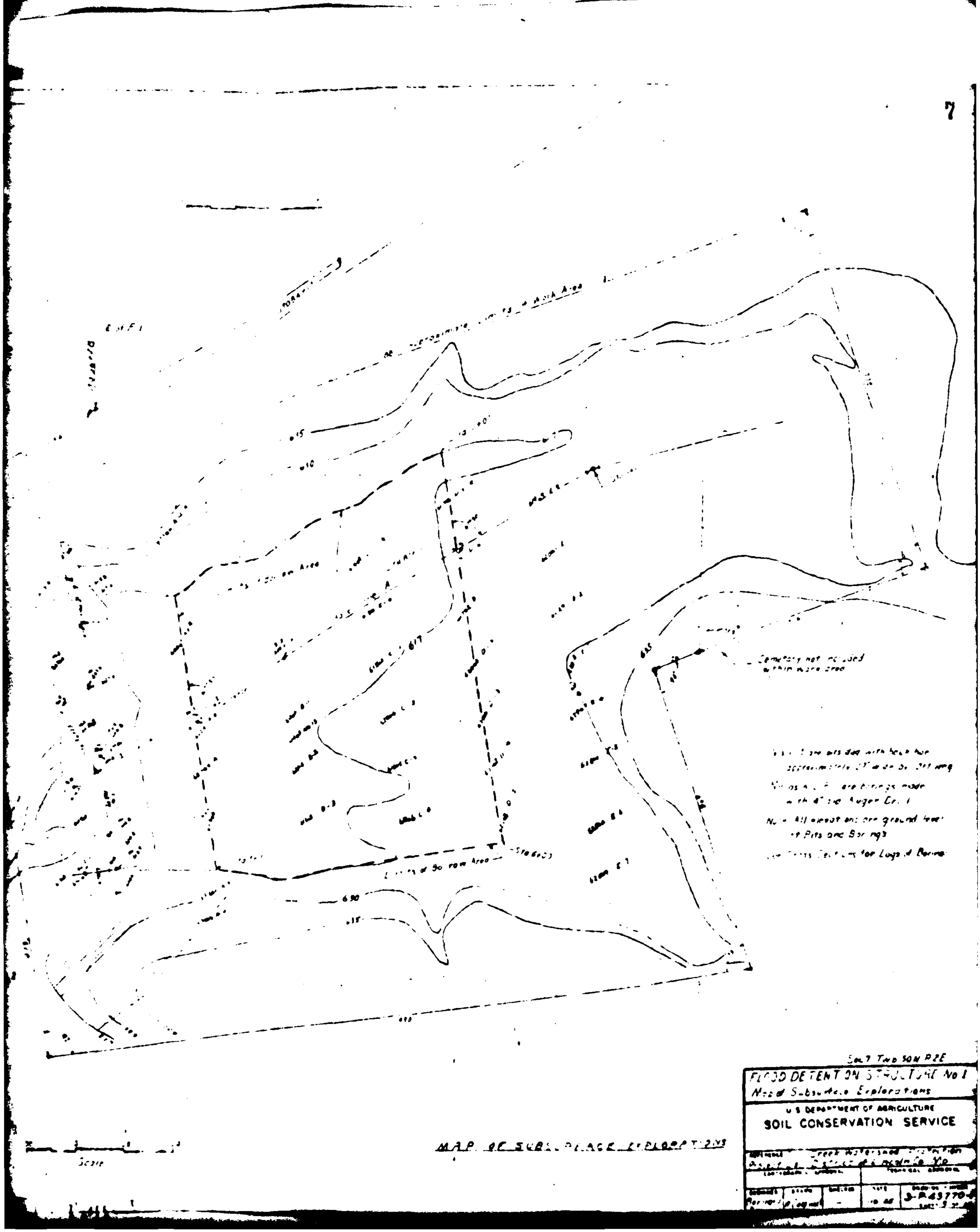
LEGENDS & INFORMATION

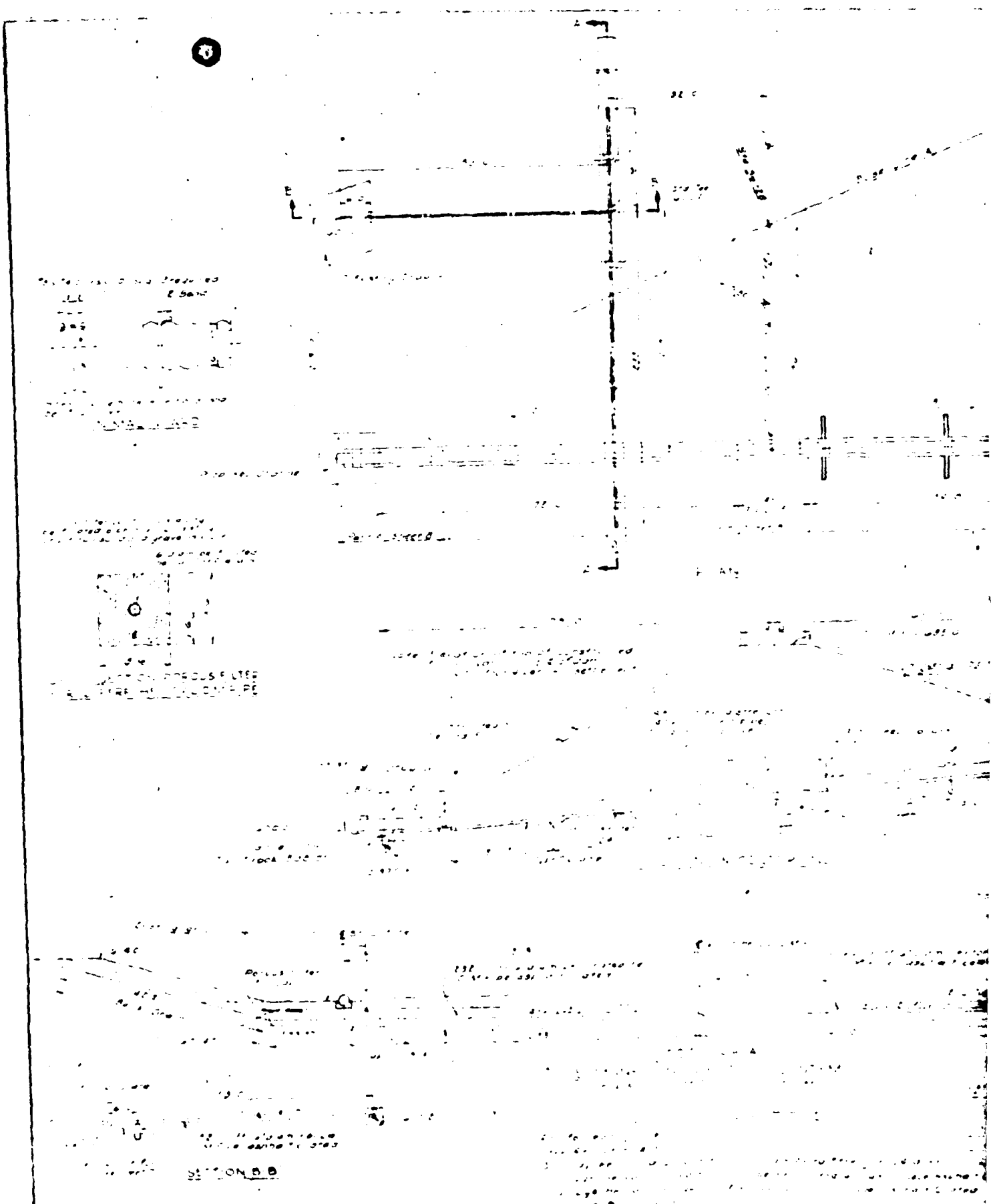
US DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

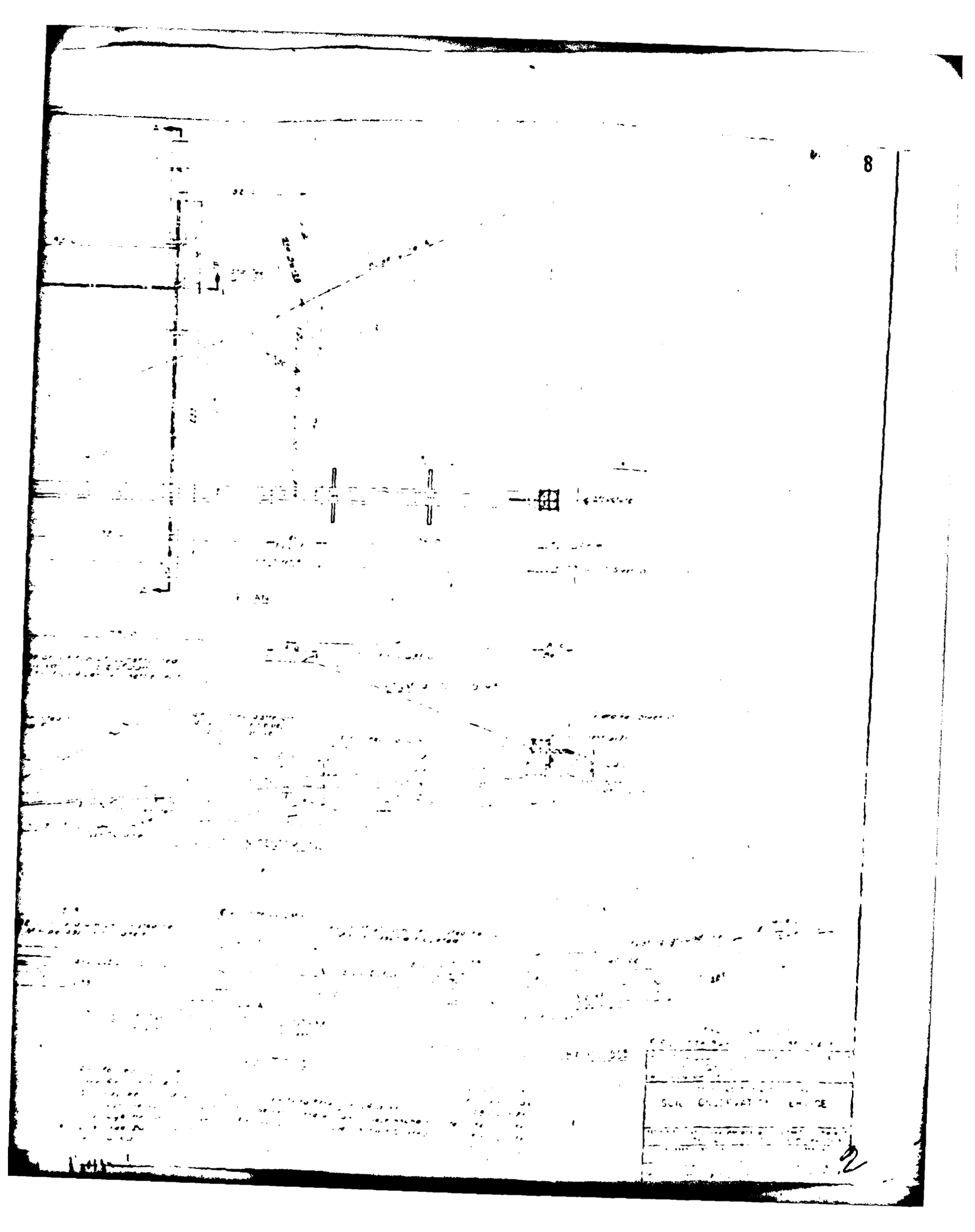
SD 4377

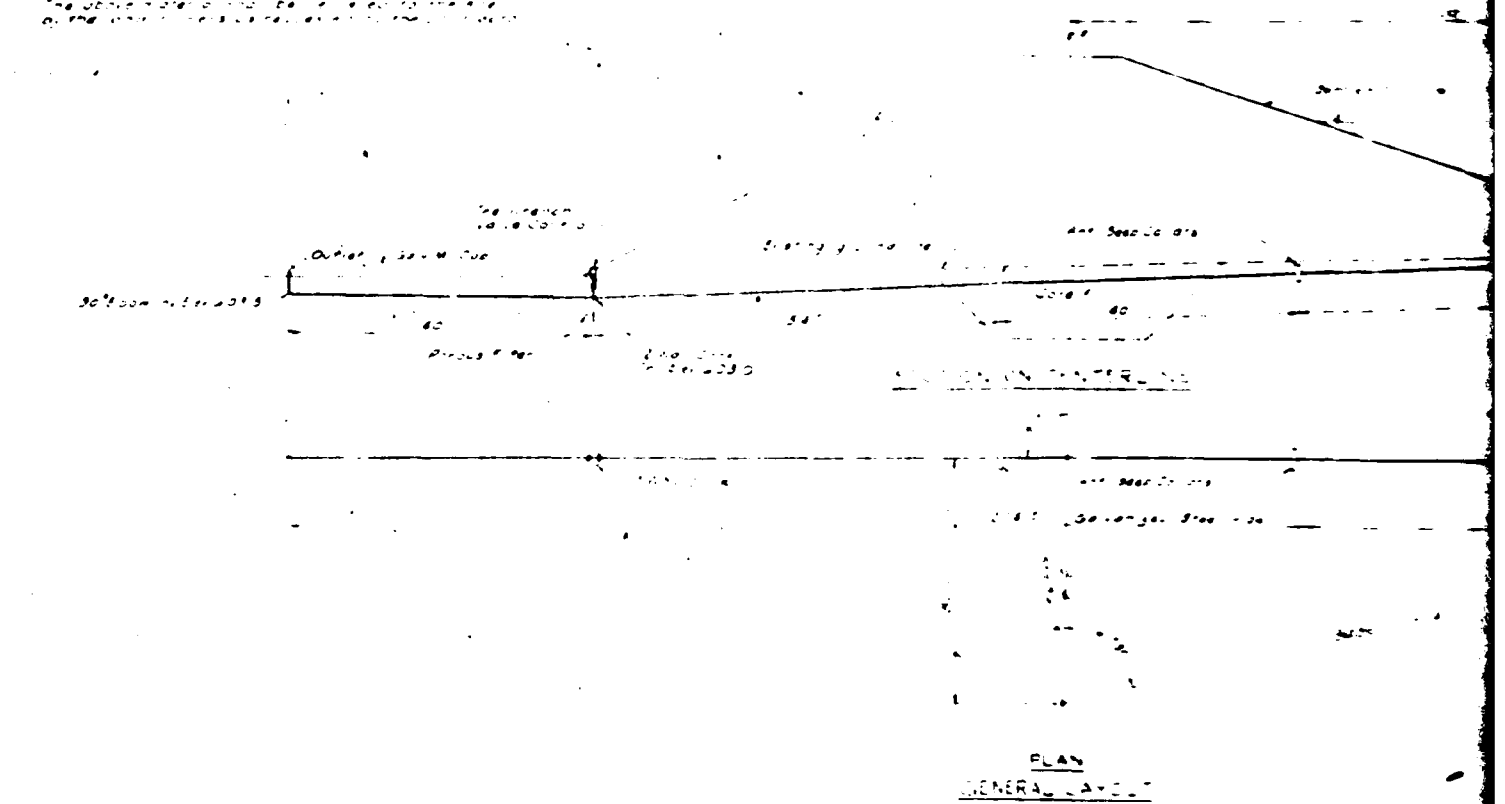



Ave Bank
6 th Bottom
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

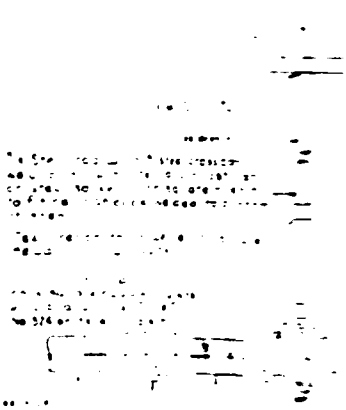

Cemetery not included within work area
Note All elevations are ground level at Pits and Borings
Sec 7 Twp 50N R2E
FLOOD DETENTION STRUCTURE No 1
U S DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE
Scale
MAP OF SUBSURFACE EXPLORATIONS

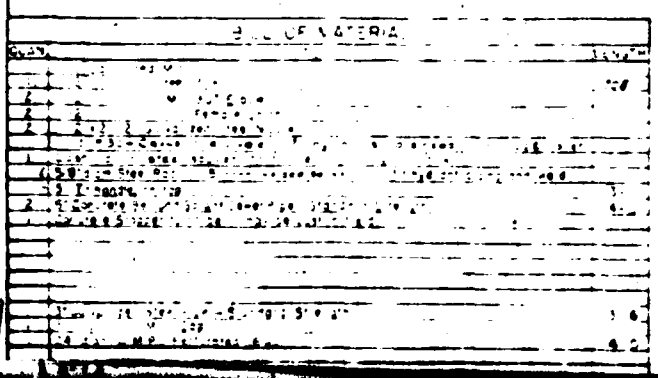


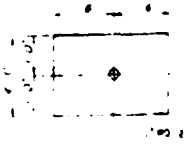




PLAN

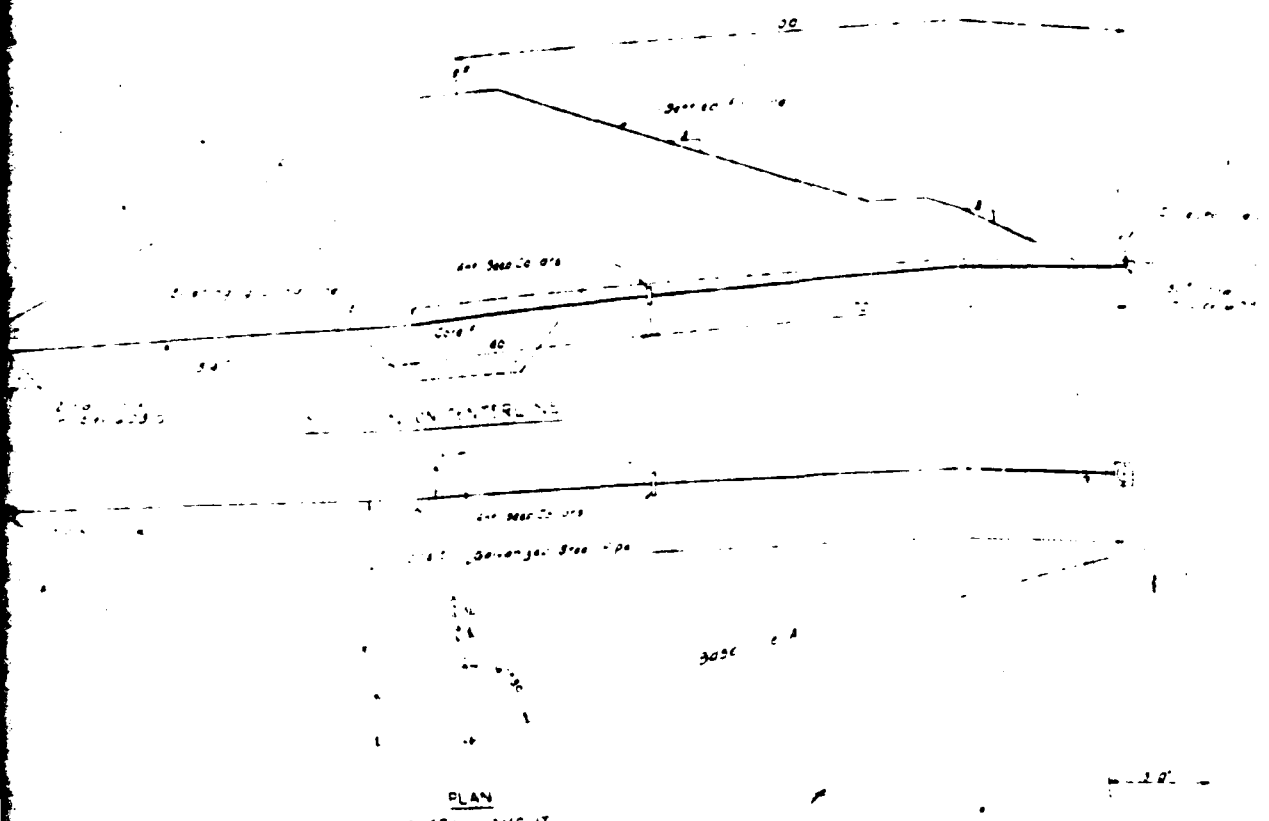




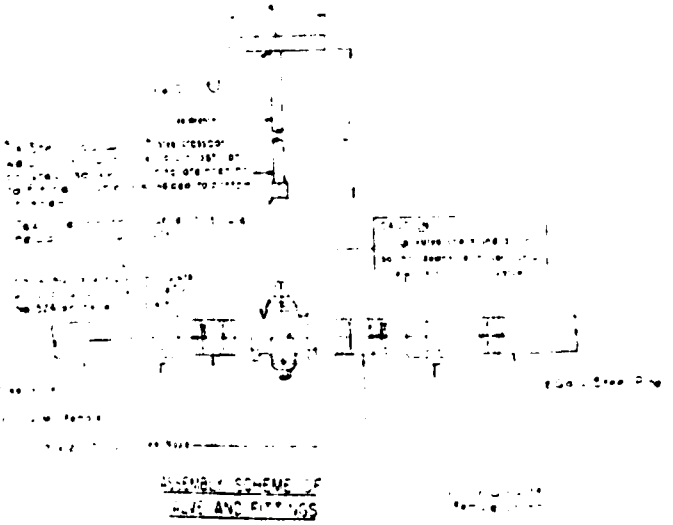


ANTI SEEP COLLAR

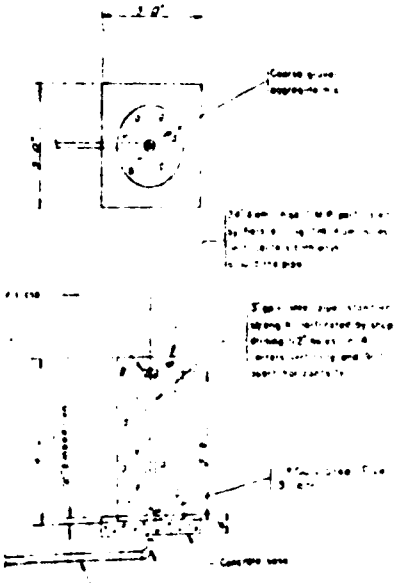
STOCK WATER



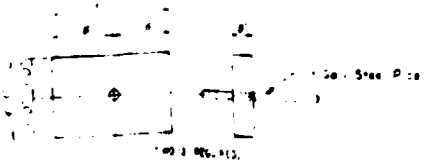
PLAN
GENERAL LAYOUT



ASSEMBLY SCHEME OF
PIPE AND FITTINGS



COLLECTOR WELL DETAIL



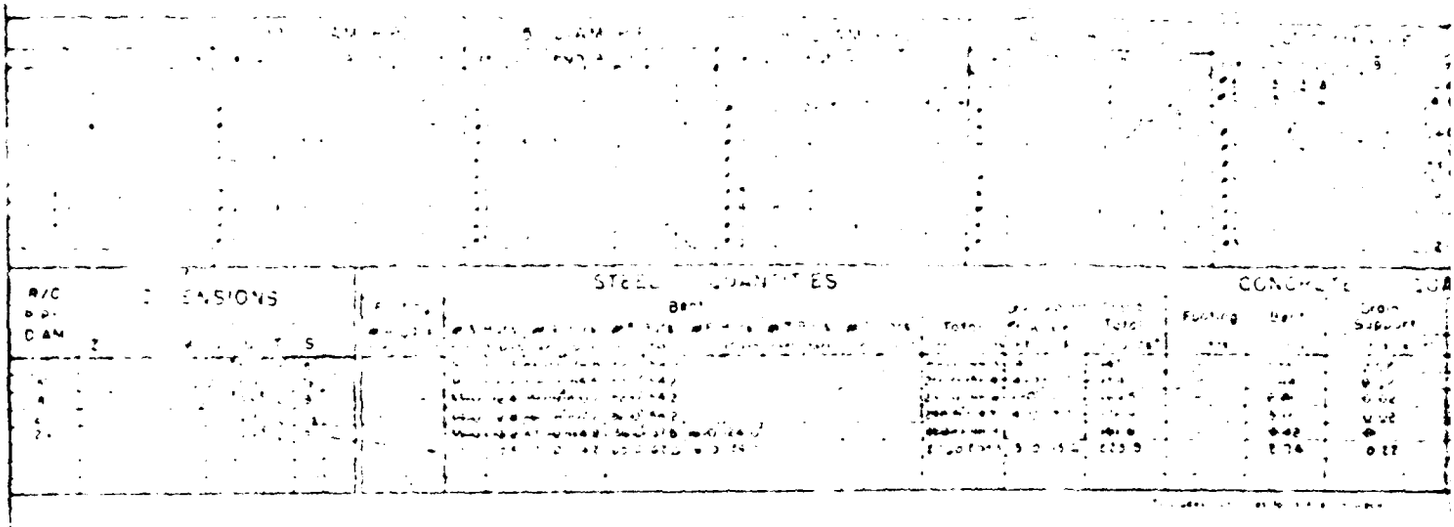
ANTI SEEP COLLAR DETAIL

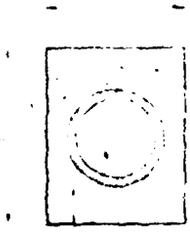
CONCRETE

Anti seep Collars 6
Collector Base — 0.46 Cu Yd

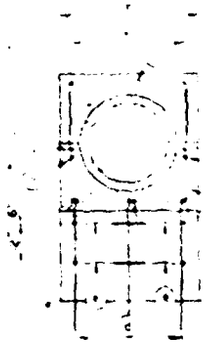
STOCK WATER SYSTEM DETAILS	
U.S. DEPARTMENT OF AGRICULTURE SOIL CONSERVATION SERVICE	
	SHEET 3 OF 49 SHEETS

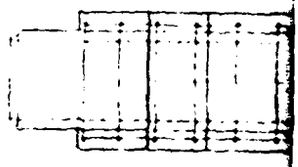
STOCK WATERING SYSTEM DETAILS



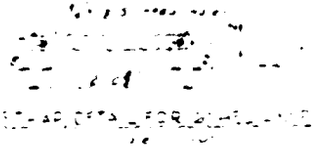


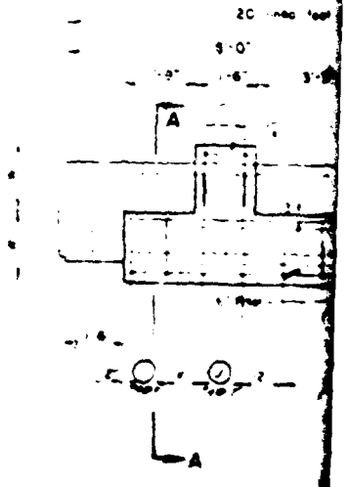
SECTION B-B

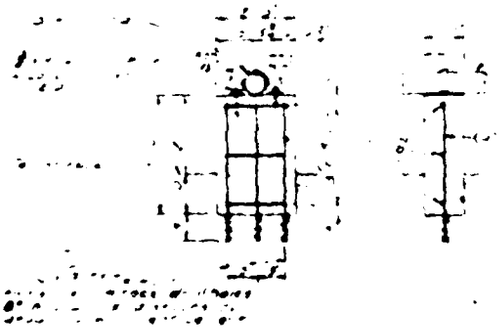


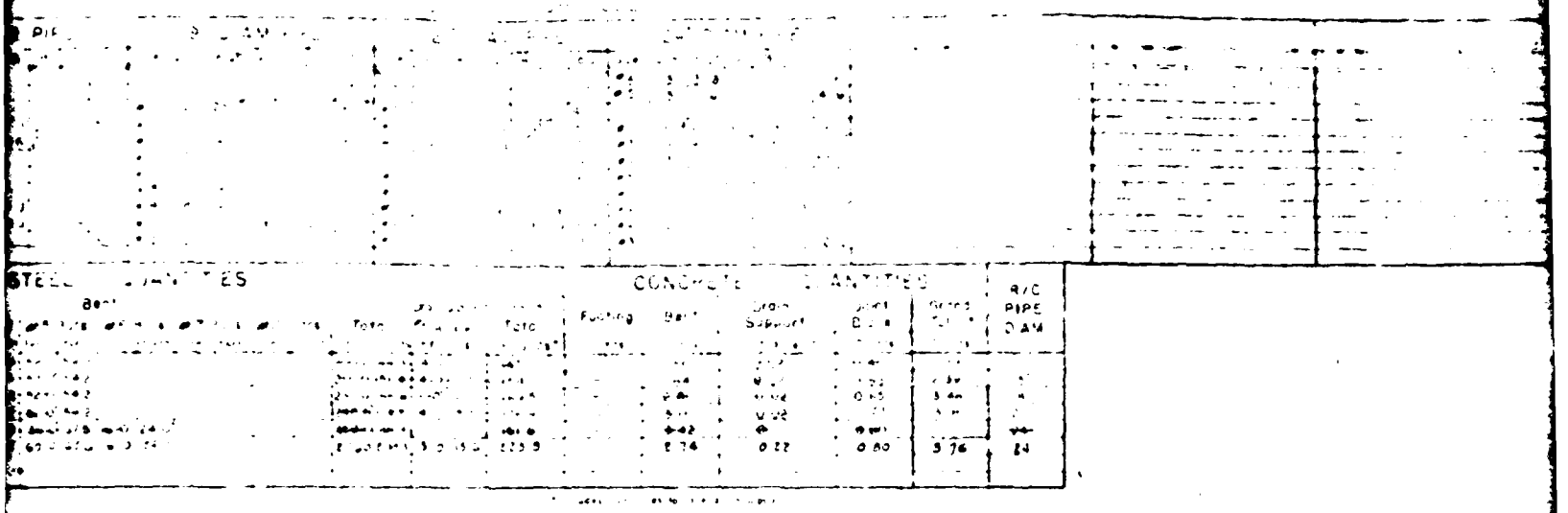


SECTION A-A

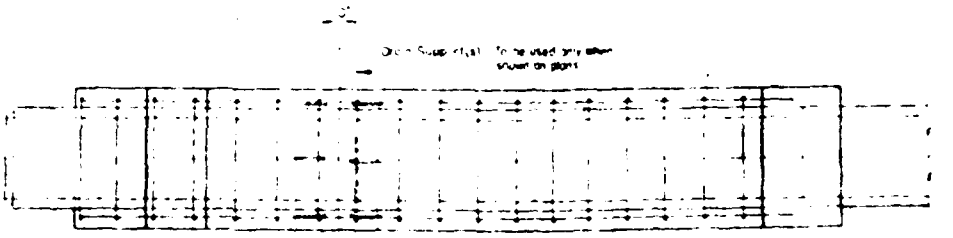






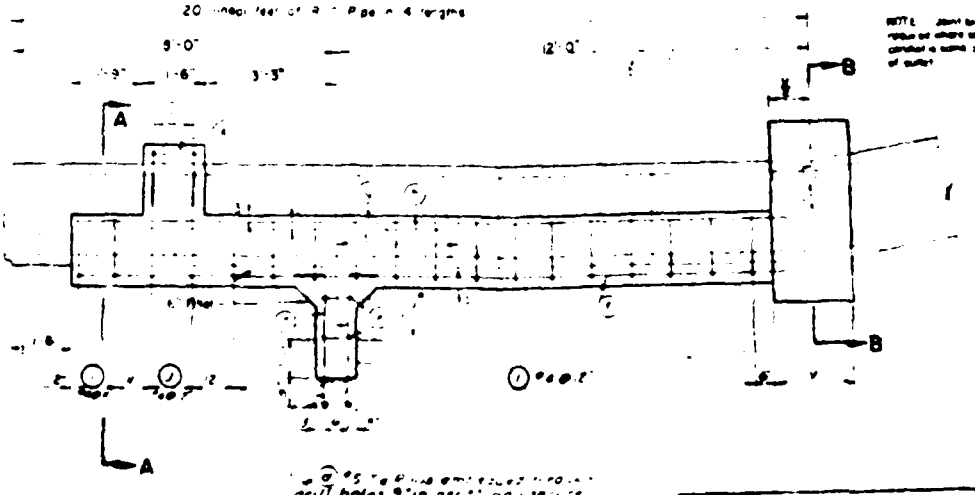


STEEL QUANTITIES				CONCRETE QUANTITIES					R/C PIPE DIAM
Bars		Total		Footing	Bars	Wall Support	Wall & Base	Curbs	
60			225.9		2.74	0.22	0.80	3.76	24



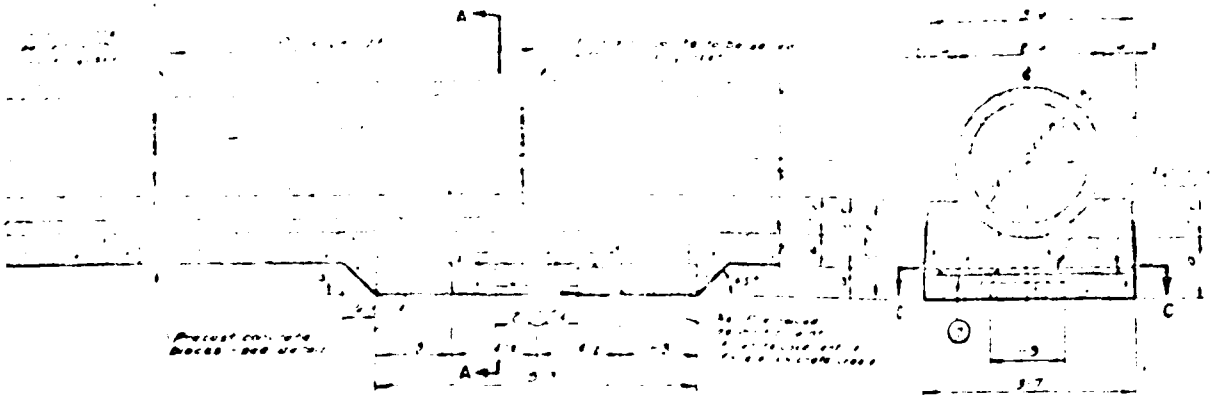
PLAN

SECTION A-A



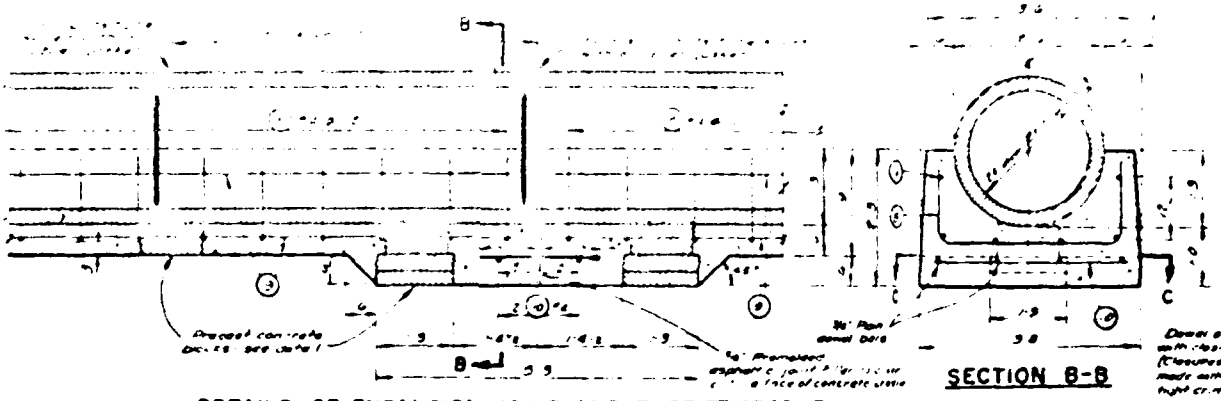
STANDARD DETAILS FOR CANTILEVER R/C PIPE OUTLET

U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE



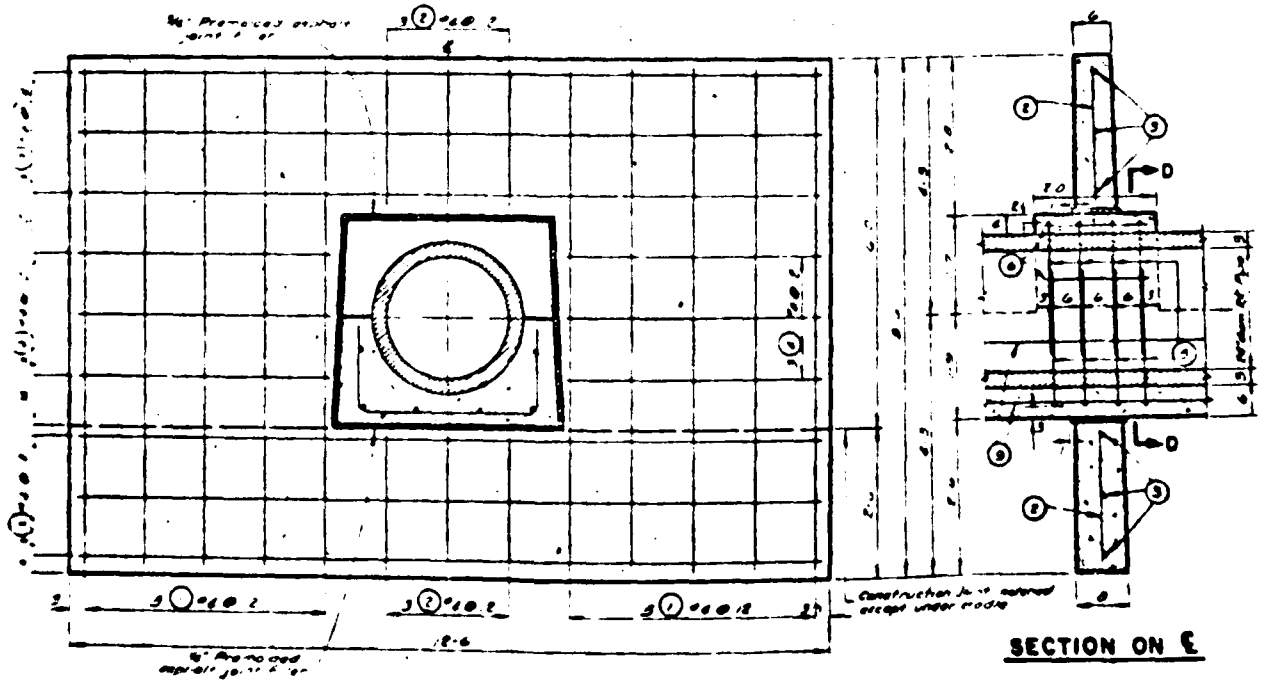
SECTION A-A

DETAILS OF EXPANSION JOINT AND TYPE II CRADLE



SECTION B-B

DETAILS OF EXPANSION JOINT AND TYPE III CRADLE



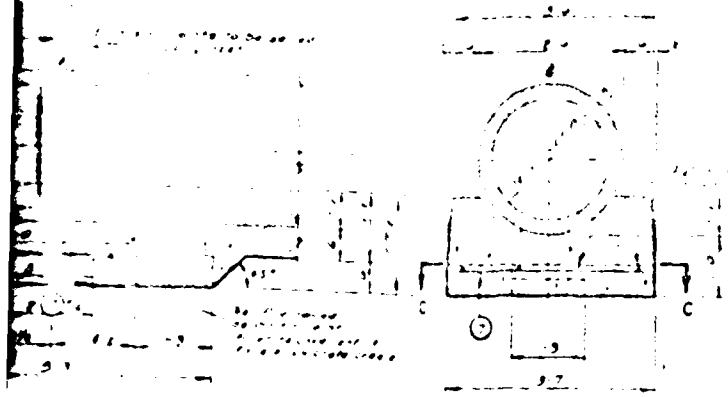
SECTION ON ℄

ELEVATION OF ANTI-SEEP COLLAR

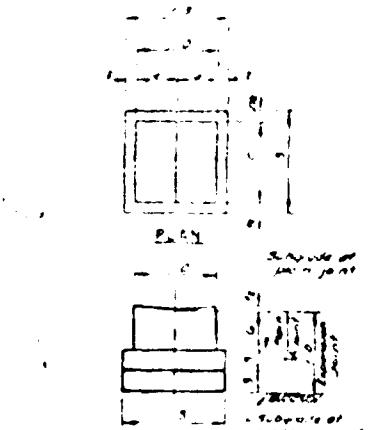
STEEL SCHEDULE 11

Location	No.	Size	Grade	Type	A	B	L	Total Feet
ANTI-SEEP COLLAR								
Collar	1	#6	60	6 S	1			81 6
"	2	"	"	6 S	1			19 6
"	3	"	"	6 S	1			79 6
"	4	"	"	6 S	1			19 6
"	5	"	"	7 S	4	2'-6"	11'-2"	30 0
"	6	"	"	7 S	1			7 0
				Total per Collar				236 0
* Alternate # bars when Type III Cradle is used								263 6
TYPE II CRADLE								
Expansion joint	7	#4	2	3 S	1			4 0 **
TYPE III CRADLE								
Cradle	8	#4		3 S	4	3	2'-6"	3 S ***
"	9	"	6	7 O	1			6 0 ***
Expansion joint	10	"	2	3 S	1			6 0 **
** per Expansion Joint								
*** per 44 of Cradle								

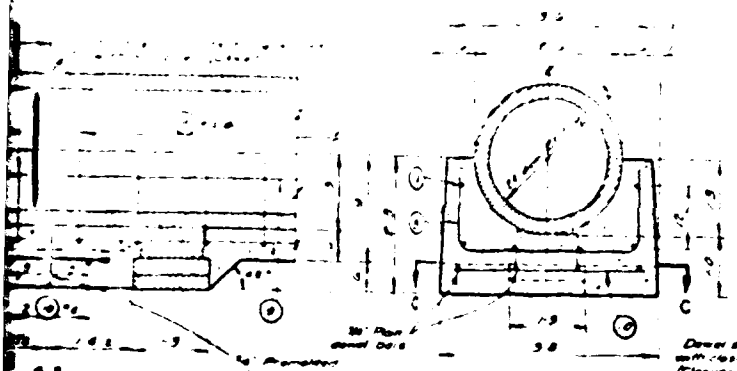
JOINT AND TYPE II CRADLE



SECTION A-A

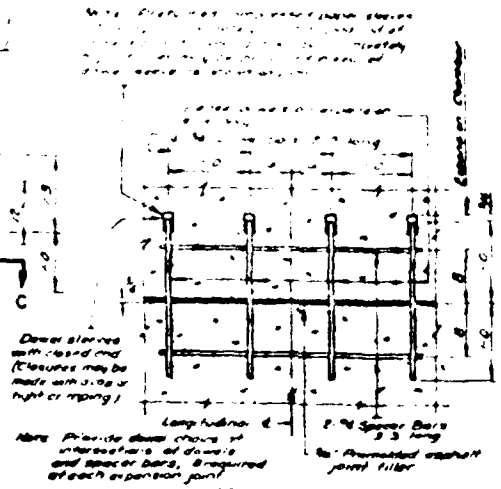


PRECAST [illegible] CLOCK



SECTION B-B

JOINT AND TYPE III CRADLE



SECTION C-C

QUANTITIES

ANTI-SEEP COLLAR WITH TYPE II CRADLE

874.00 Linear feet #6 Steel bars 183.0 lbs/Collar

Concrete Volume 8.31269 Cu Yds.*

ANTI-SEEP COLLAR WITH TYPE III CRADLE

[illegible] Linear feet #6 Steel bars 176.0 lbs/Collar

Concrete Volume 8.24/36 Cu Yds *

* Volume does not include cradle

TYPE II CRADLE (per lineal ft)

Concrete Volume 0.11203 Cu Yds.

TYPE III CRADLE (per lineal ft)

11.75 Linear feet #6 Steel bars 7.8 lbs

Concrete Volume 0.10135 Cu Yds

EXPANSION JOINT (per Exp Joint)

6.50 Linear feet #6 Steel bars 4.3 lbs

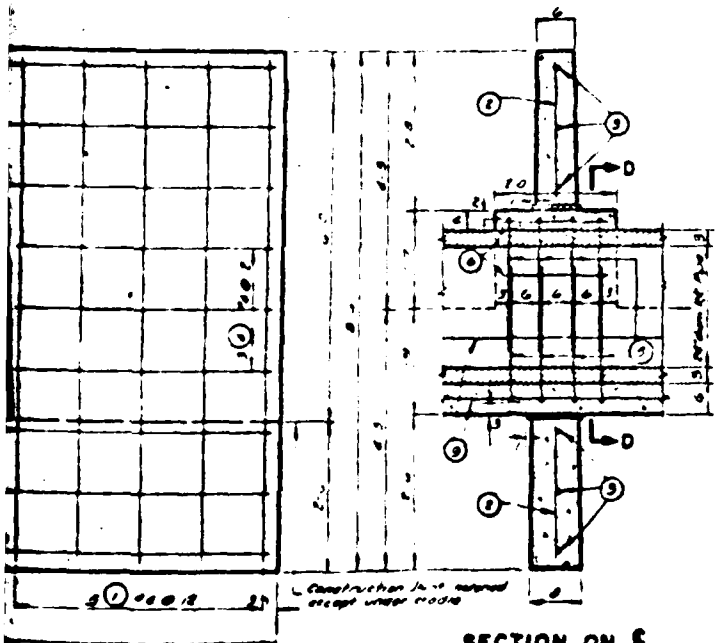
Concrete Volume Type II - 0.50156 Cu Yds

" " Type III - 0.39043 Cu Yds

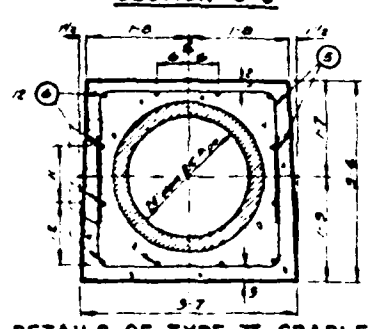
DOWEL BARS

16" Plain dowel bars, 2'-0" long, with dowel sleeves, 6 required per Exp Joint

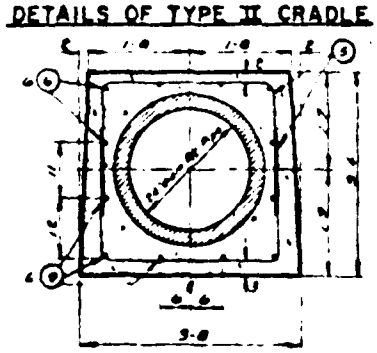
NOTE: Only "TYPE II CRADLE" will be used on this contract.



SECTION ON ℄



DETAILS OF TYPE II CRADLE



DETAILS OF TYPE III CRADLE

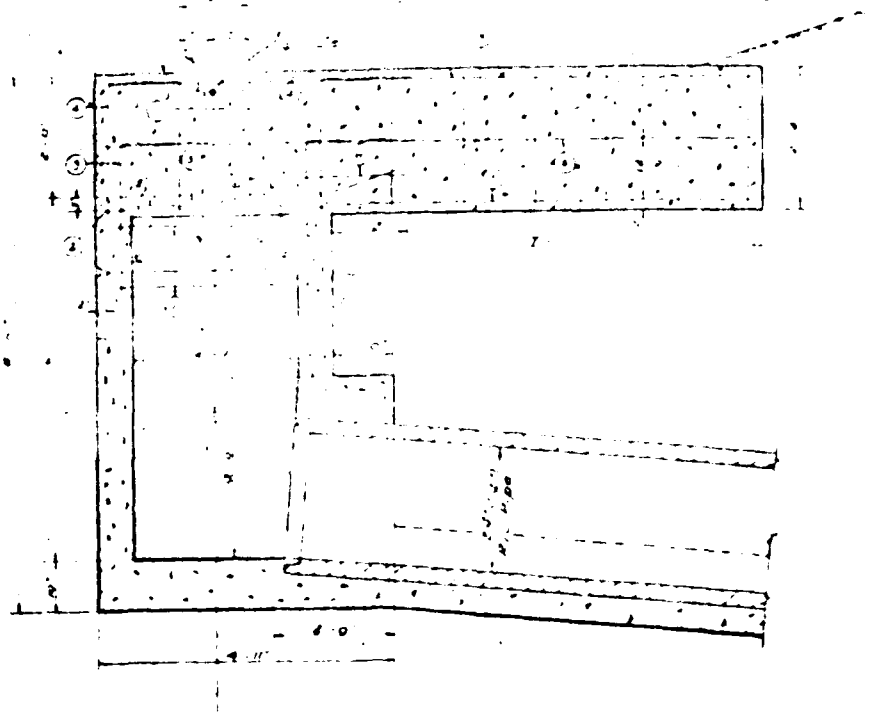
SECTION D-D

COLLAR

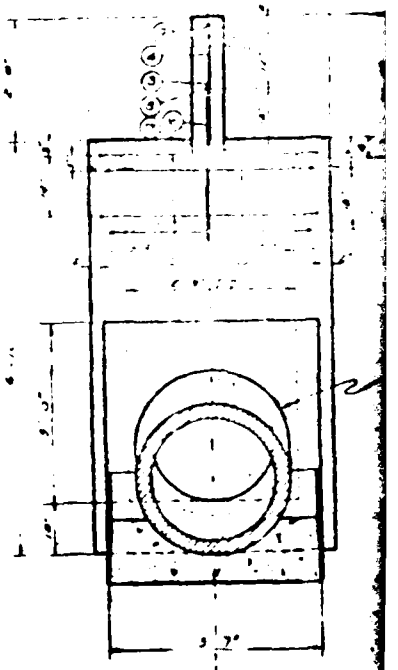
[illegible] REINFORCED CONCRETE DROP INLET 24" P[illegible]
DETAILS OF TYPE II, III CRADLE, ANTI-SEEP COLL[illegible]

U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

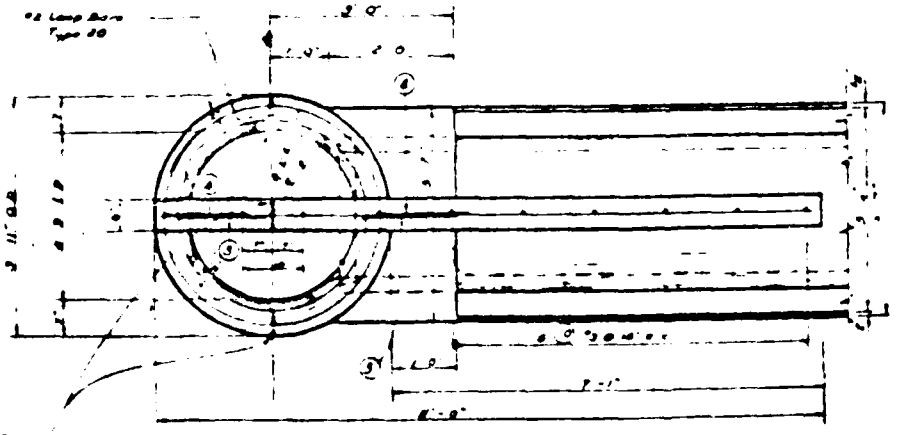
[illegible]



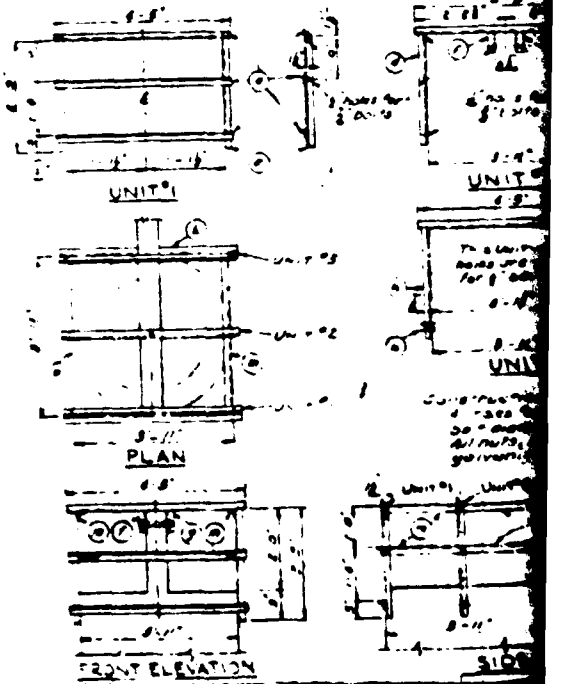
SECTION ON CENTERLINE

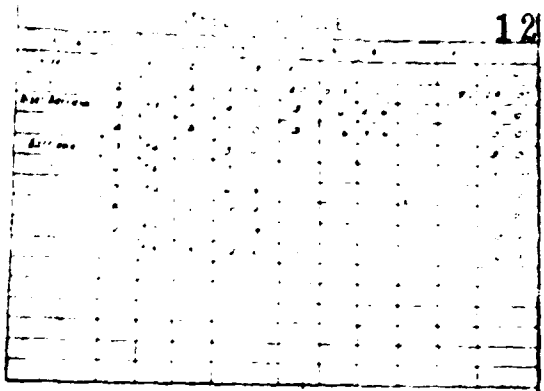


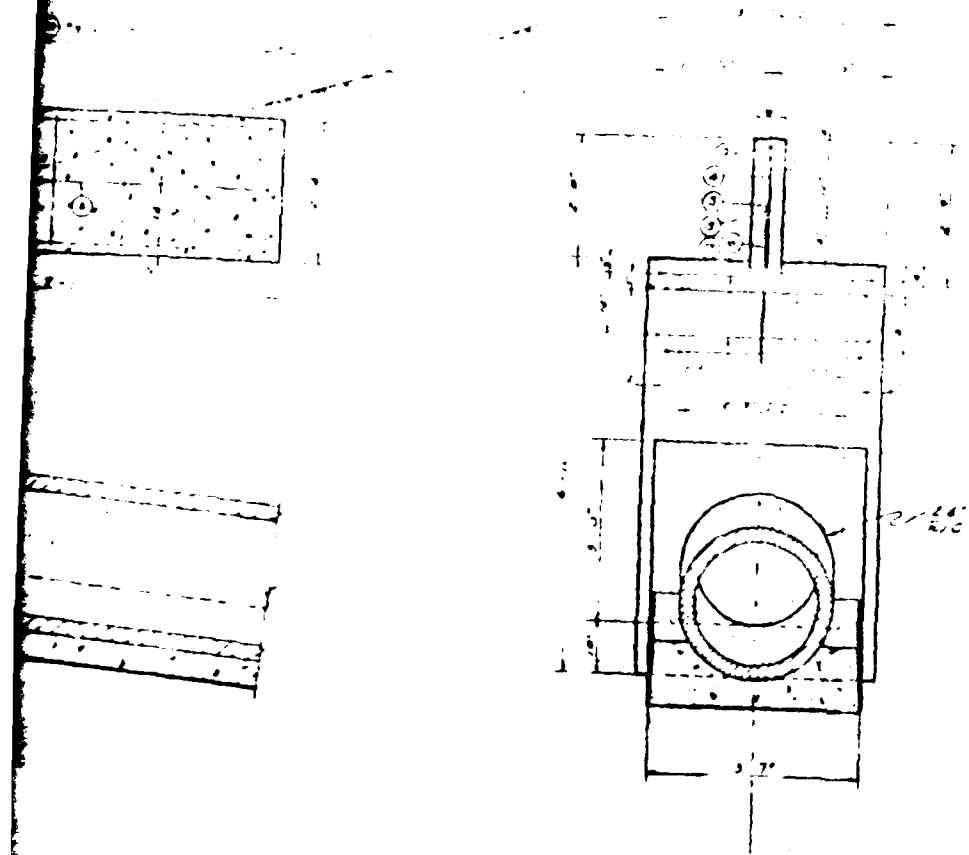
REAR ELEVATION



PLAN







QUANTITIES

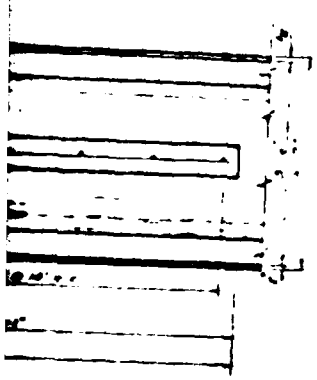
STEEL	#2	453 Lin. Ft.	70 lbs.
	#3	183 " "	62 "
	#4	47 " "	37 "
	#5	31.75 " "	33 "

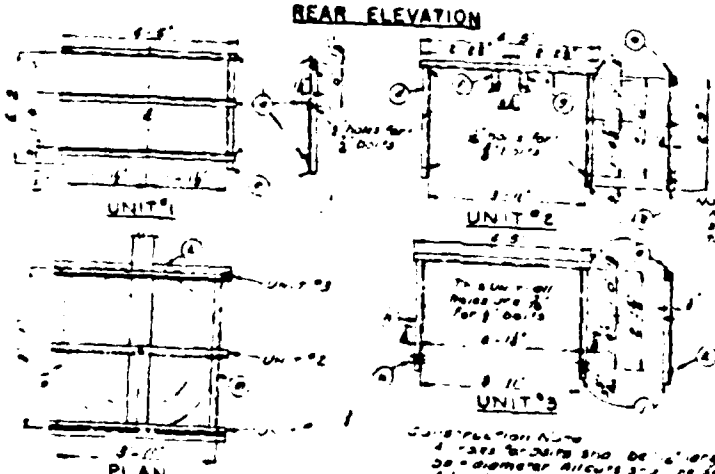
Concrete 10 cu. yds. 2.5 cu. yds.

BILL OF MATERIAL FOR GUARD RAIL

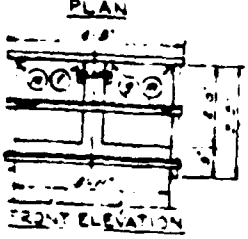
MARK	NO.	ITEM	LENGTH
A	3	6"x6" x Steel Angle	6'-3"
B	1	" " "	2'-3"
C	1	" " "	2'-9"
D	1	" " "	2'-8"
E	1	" " "	2'-3"
F	1	" " "	0'-6"
G	1	" " "	0'-6"
H	1	" " "	2'-3"
J	1	" " "	2'-3"
K	1	" " "	2'-3"
L	1	" " "	4'-3"
M	6	" " "	3'-1"
	16	5/8" ø M Bolt w/Lock Washer	0'-10"
	1	1/2" ø U Bolt w/Flat & Lock Washer	0'-8"
	2	" " "	0'-9"
	1	5/8" ø Pipe	0'-6"
	2	" " "	0'-7"

REAR ELEVATION

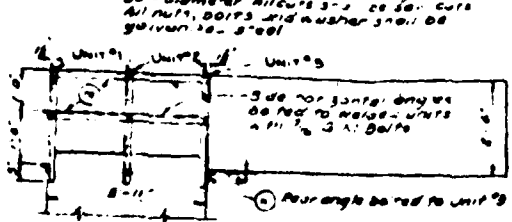




PLAN

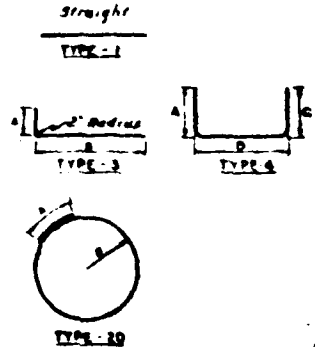


FRONT ELEVATION



SIDE ELEVATION

BAR TYPE DETAILS

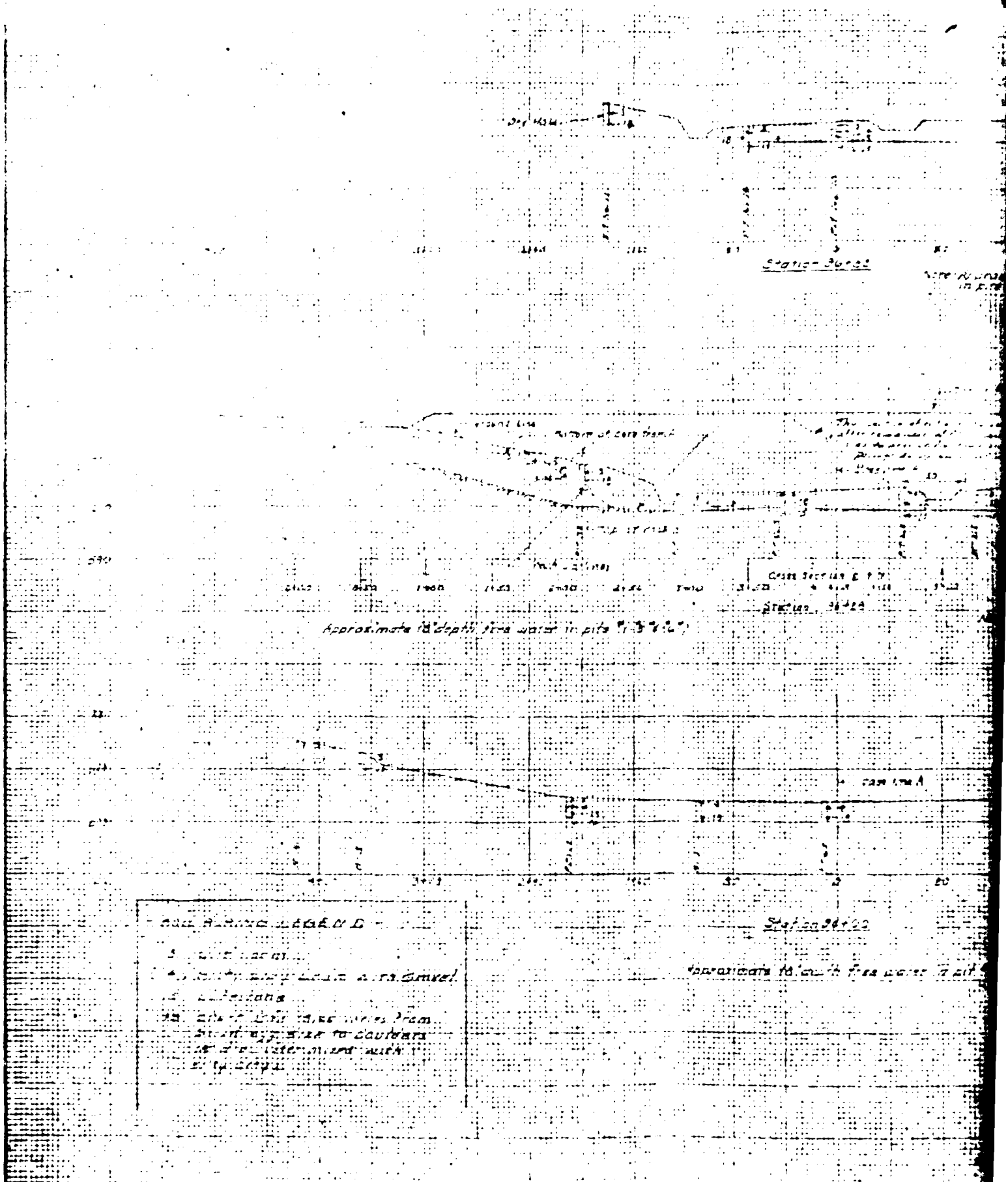


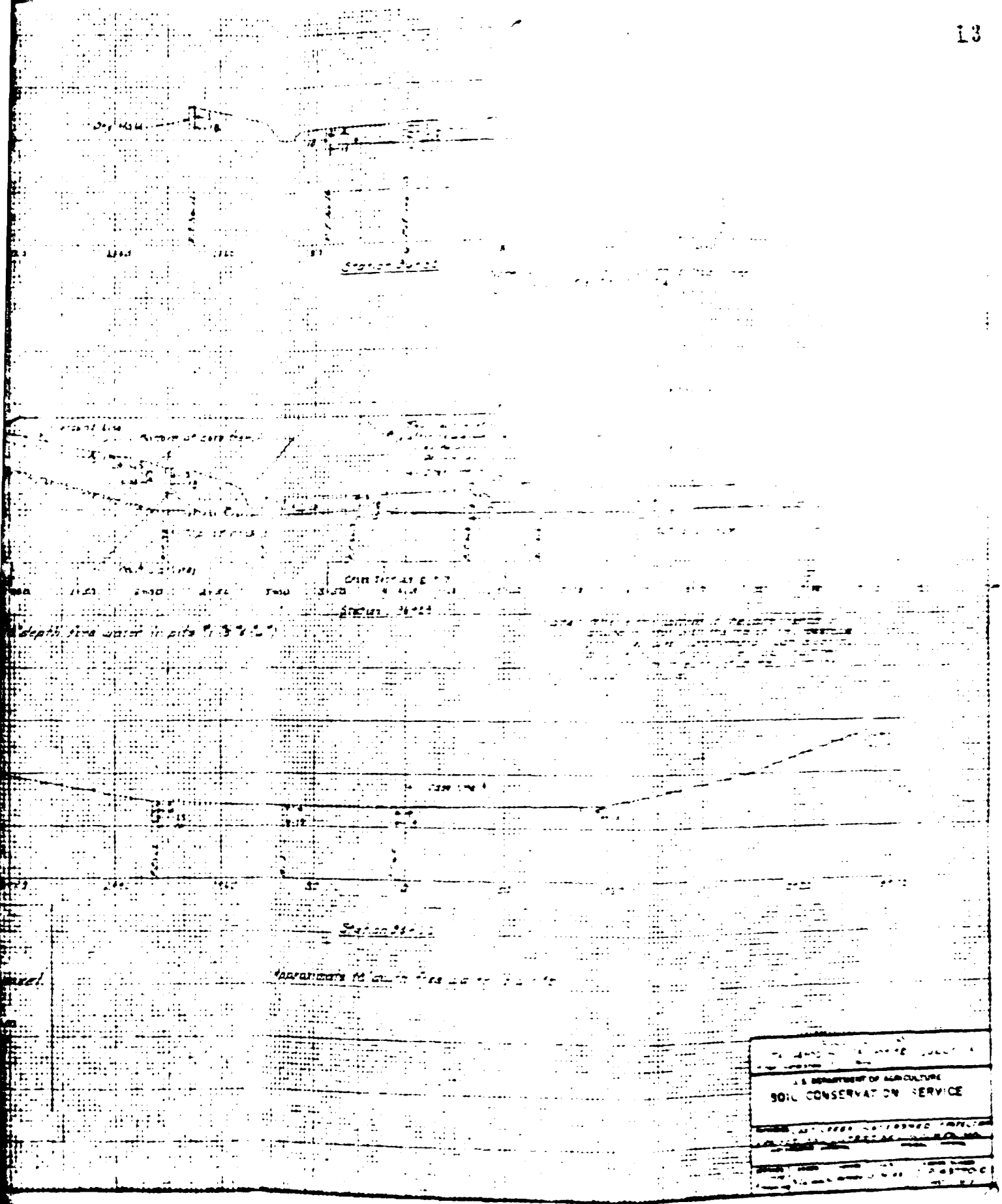
Construction Note
Metal forms are available at the St. Charles County Soil's District office located at St. Charles, Missouri, and can be rented for a nominal fee.

MODIFICATION NO. 1 28 APRIL 1955

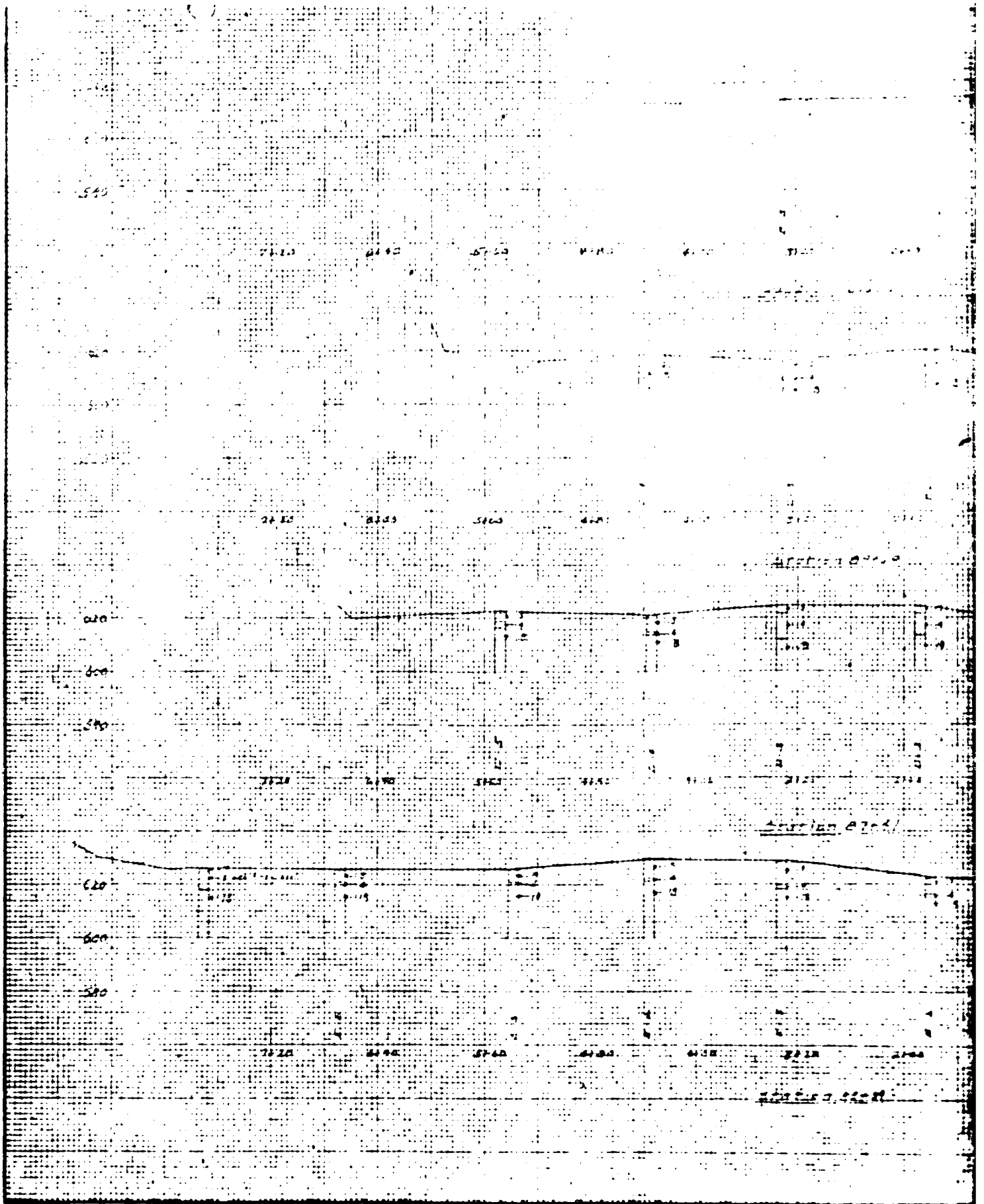
CONCRETE CIRCULAR RISER FOR 24" DIA. R/C PIPE

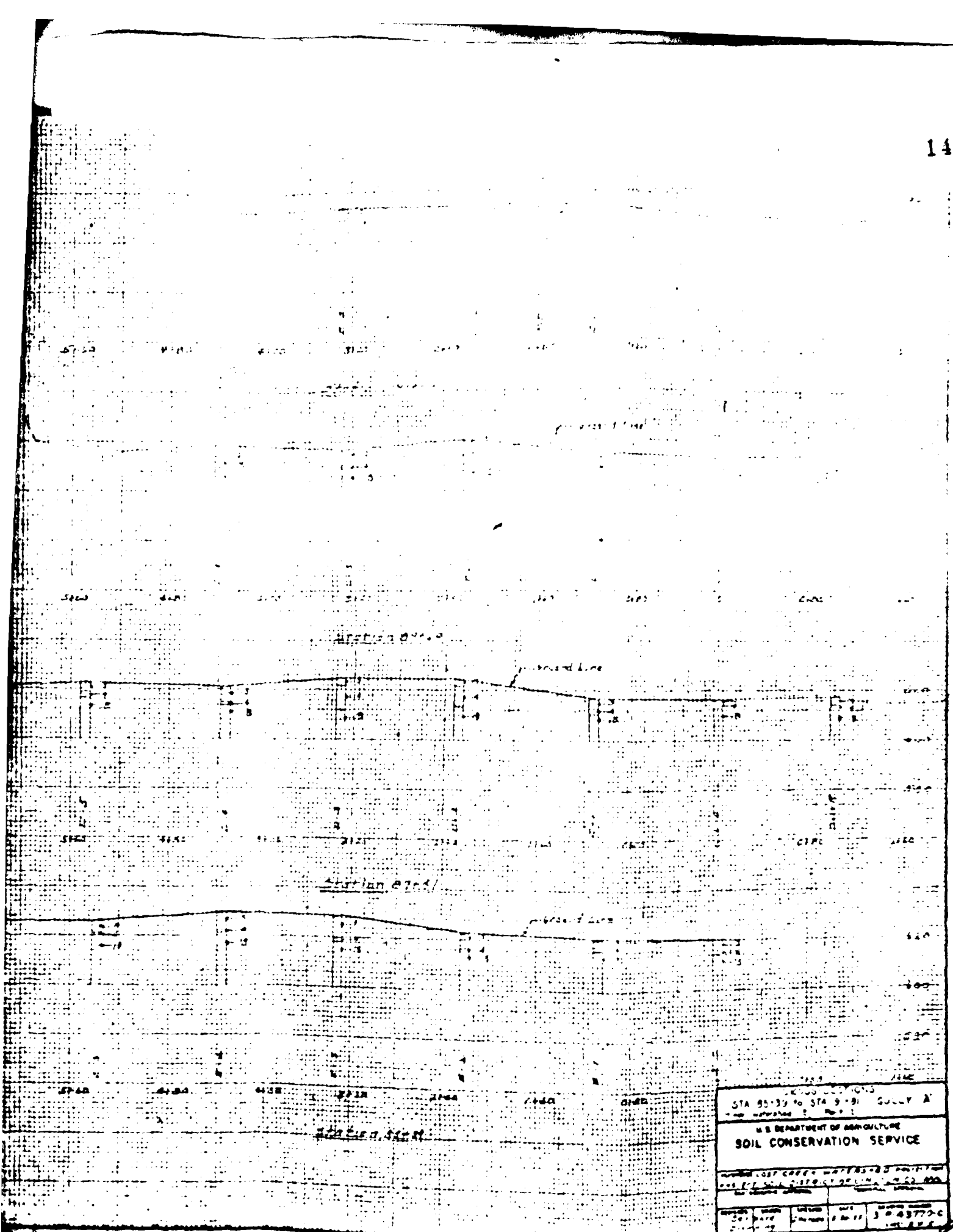
U. S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

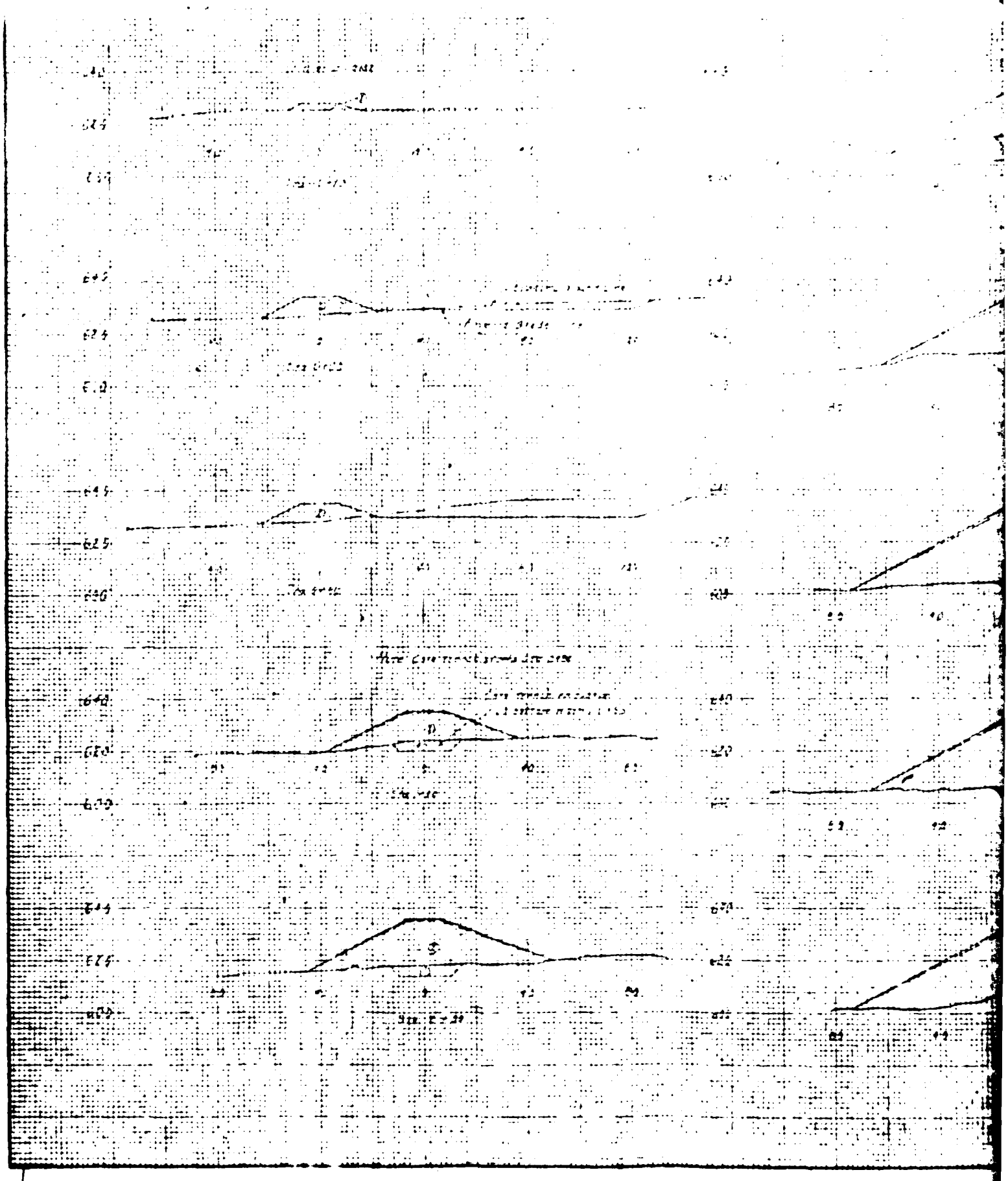


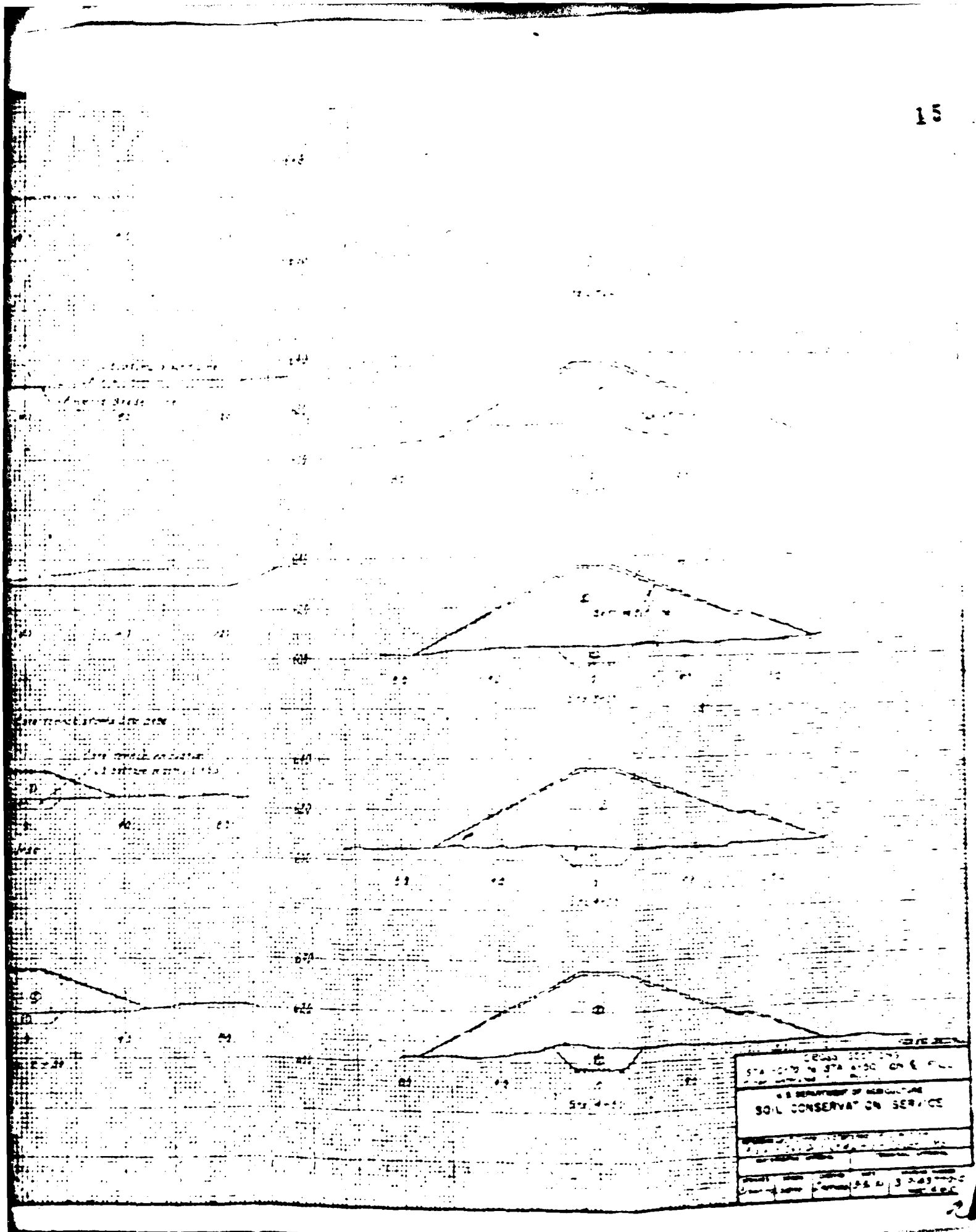


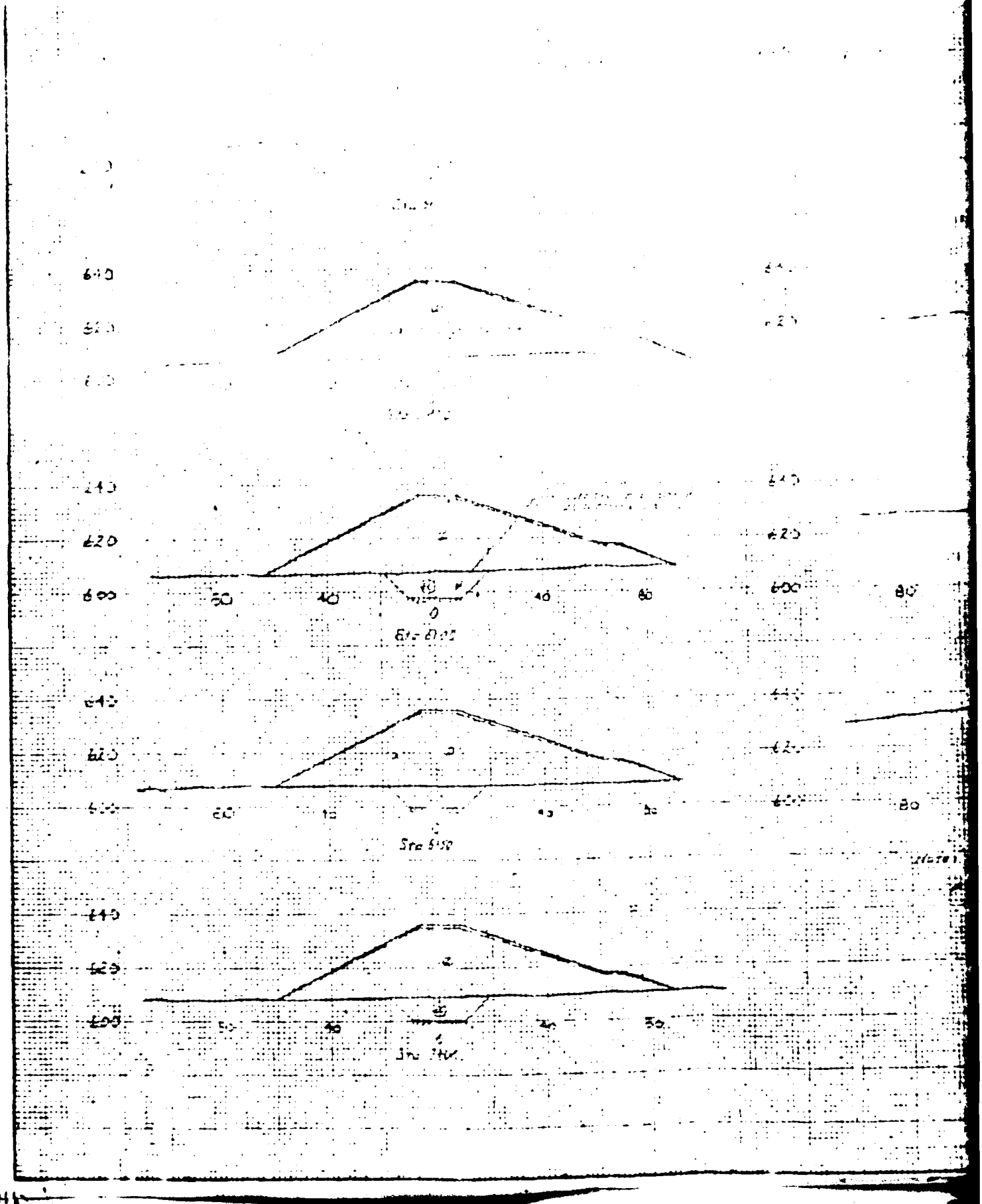
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE

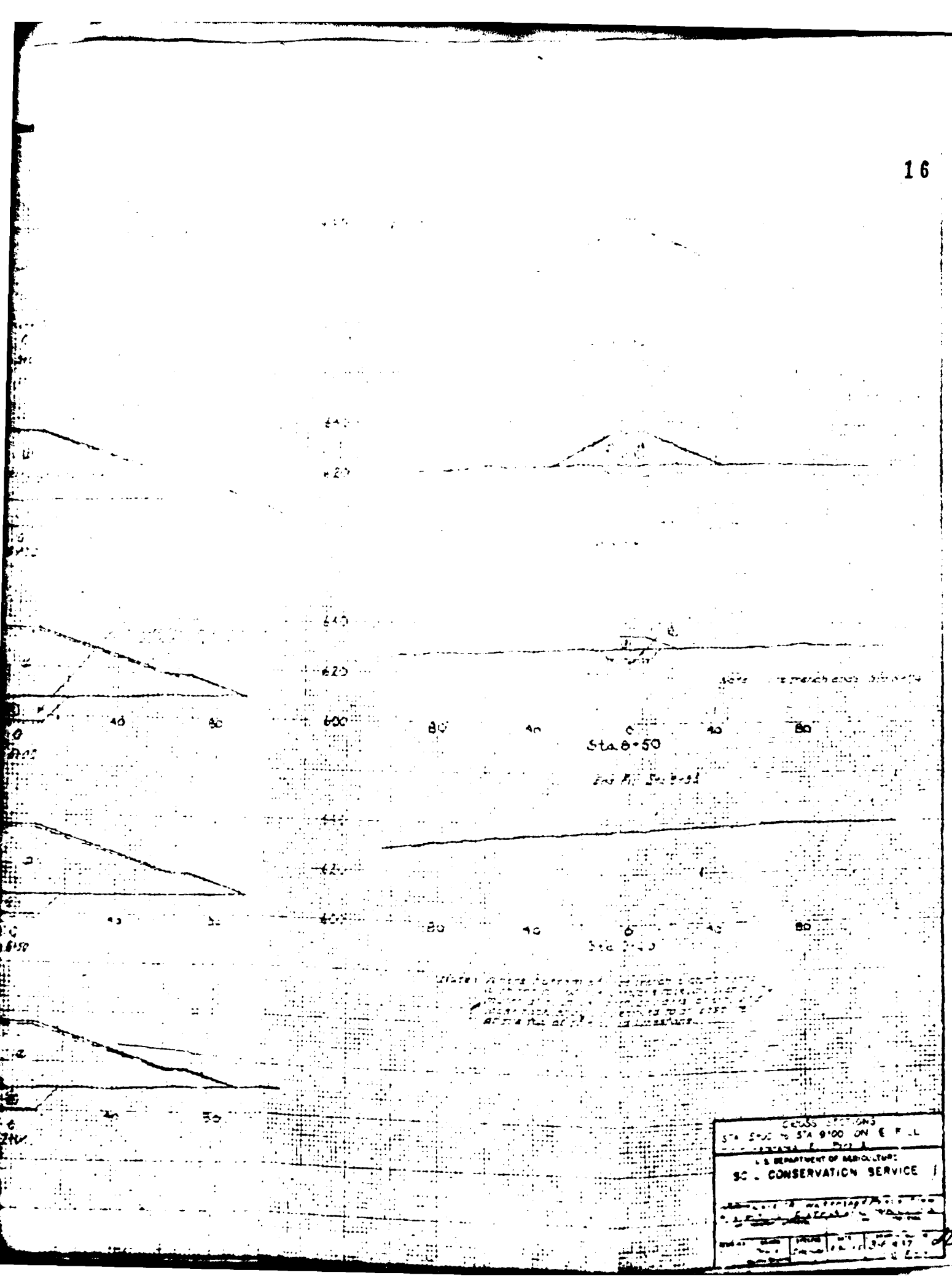


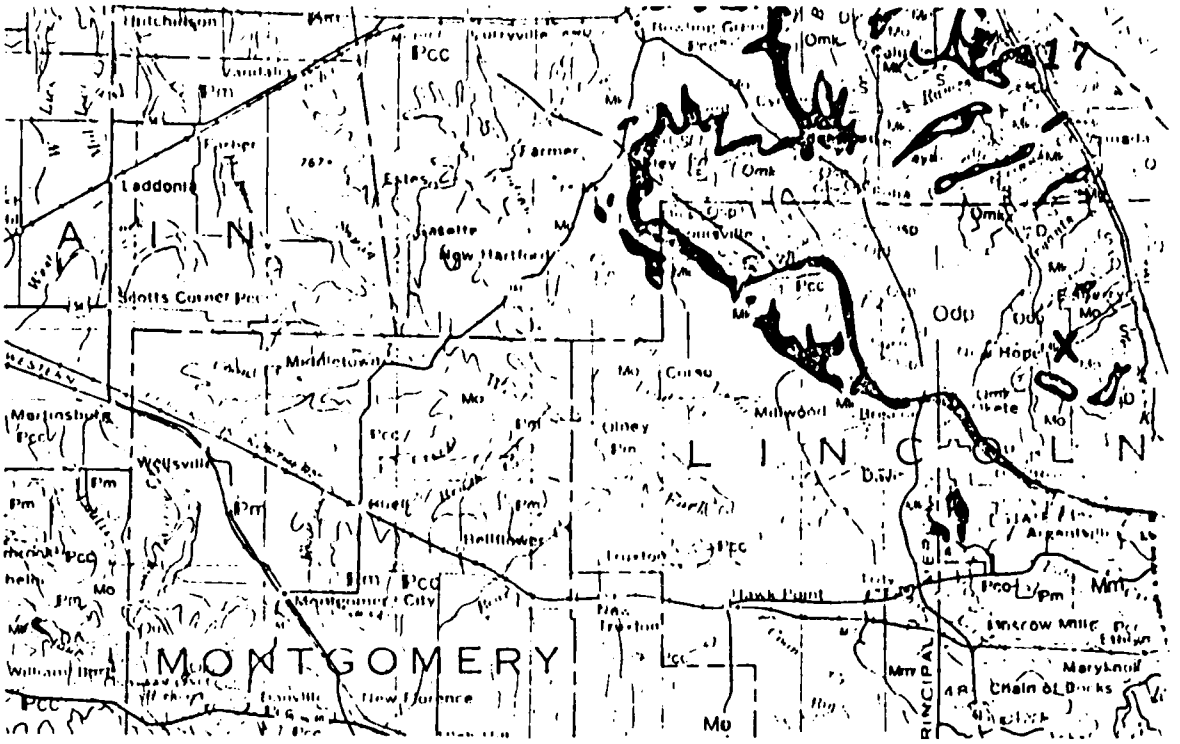

STA 95+39 to STA 9+91
U.S. DEPARTMENT OF AGRICULTURE
SOIL CONSERVATION SERVICE




SOIL CONSERVATION SERVICE




Sta 8+50
CROSS SECTIONS
STA 8+00 TO STA 9+00 ON E F L
U S DEPARTMENT OF AGRICULTURE
SC - CONSERVATION SERVICE



QUARTERNARY — Qal - ALLUVIAN

PENNSYLVANIAN — Pcc - CHEROKEE GROUP

MISSISSIPPIAN
- Mm - MERAMECIAN SERIES
- Mo - OSAGEAN SERIES
- Mk - KINDERHOOKIAN SERIES, CHOTEAU GROUP

DEVONIAN — DEVONIAN UNDIVIDED

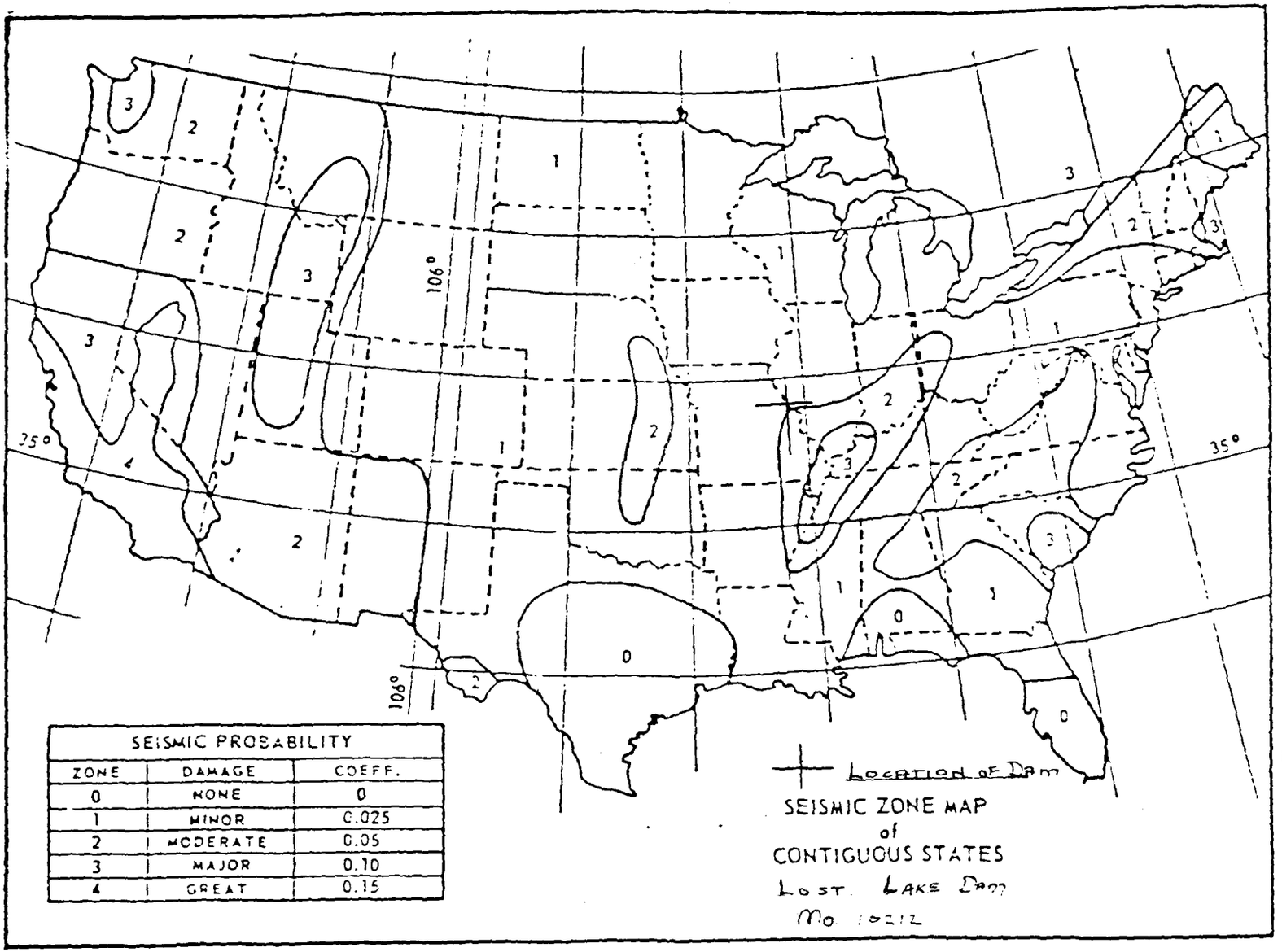
SILURIAN — S - SILURIAN UNDIVIDED

ORDOVICIAN
- Omk
  - NOIX LIMESTONE
  - MAQUOKETA SHALE
  - CAPE LIMESTONE
  - KIMMSWICK FORMATION
- Odp
  - DECORAH FORMATION
  - PLATTIN FORMATION
- Osp - ST. PETER'S SANDSTONE

X - LOCATION OF DAM, MO. 10212

REFERENCE:
GEOLOGIC MAP OF MISSOURI, MISSOURI GEOLOGIC SURVEY, a) 1961; b) 1979

GEOLOGIC MAP OF LINCOLN COUNTY AND ADJACENT AREA



SEISMIC PROBABILITY		
ZONE	DAMAGE	COEFF.
0	NONE	0
1	MINOR	0.025
2	MODERATE	0.05
3	MAJOR	0.10
4	GREAT	0.15

SEISMIC ZONE MAP
of
CONTIGUOUS STATES
Lost Lake Dam
Mo. 10212

APPENDIX A

PHOTOGRAPHS TAKEN DURING INSPECTION

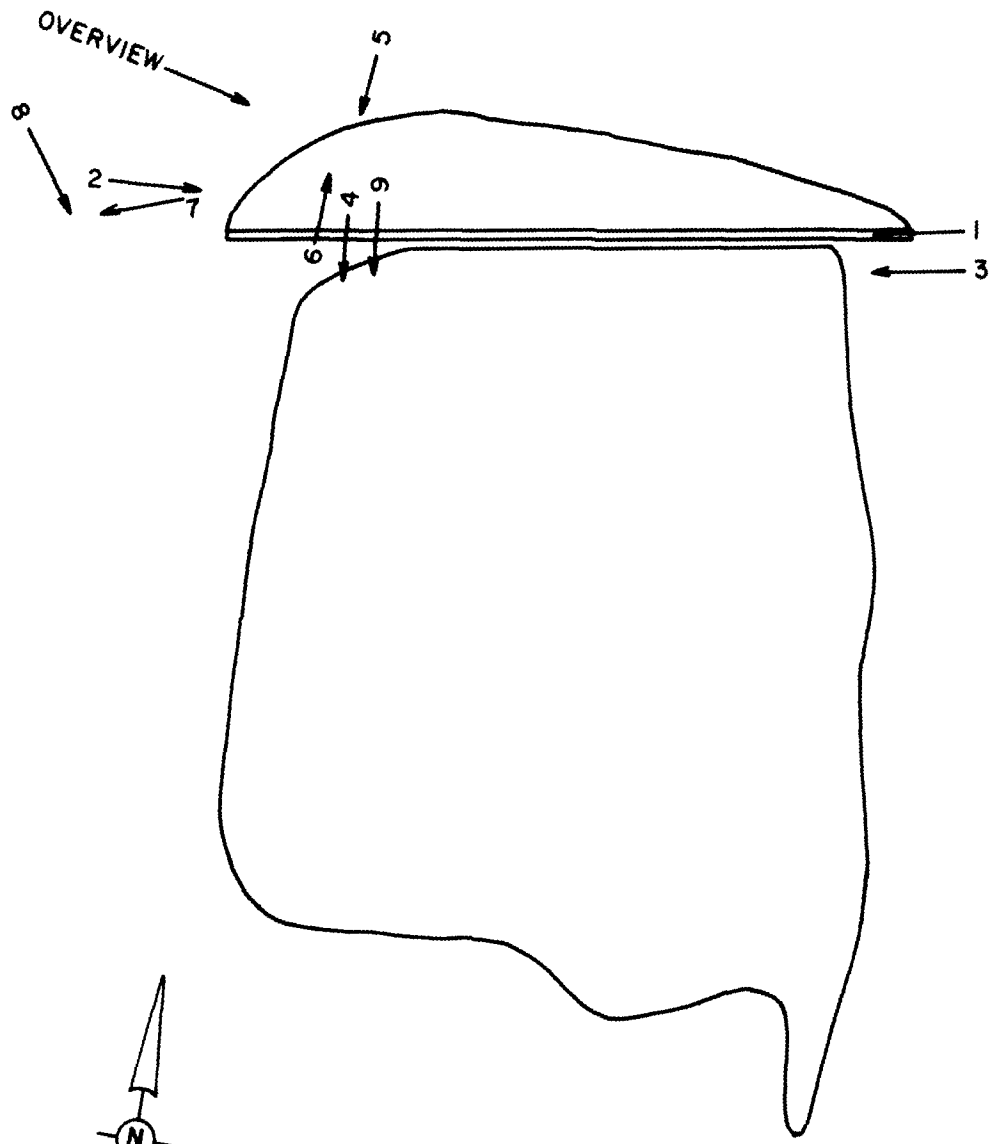


PHOTO INDEX
FOR
LOST LAKE DAM

Lost Lake Dam

Photo 1. - View of the crest of the embankment.

Photo 2. - View of the downstream embankment slope.

Photo 3. - View of the upstream embankment slope.

Photo 4. - View of the intake to drop inlet structure.

Photo 5. - View of the outlet of the 24-inch diameter concrete conduit.

Photo 6. - View of the discharge channel of the 24-inch diameter concrete conduit.

Photo 7. - View of the emergency spillway on the left abutment.

Photo 8. - View of the emergency spillway on the left abutment.

Photo 9. - View of the reservoir rim.

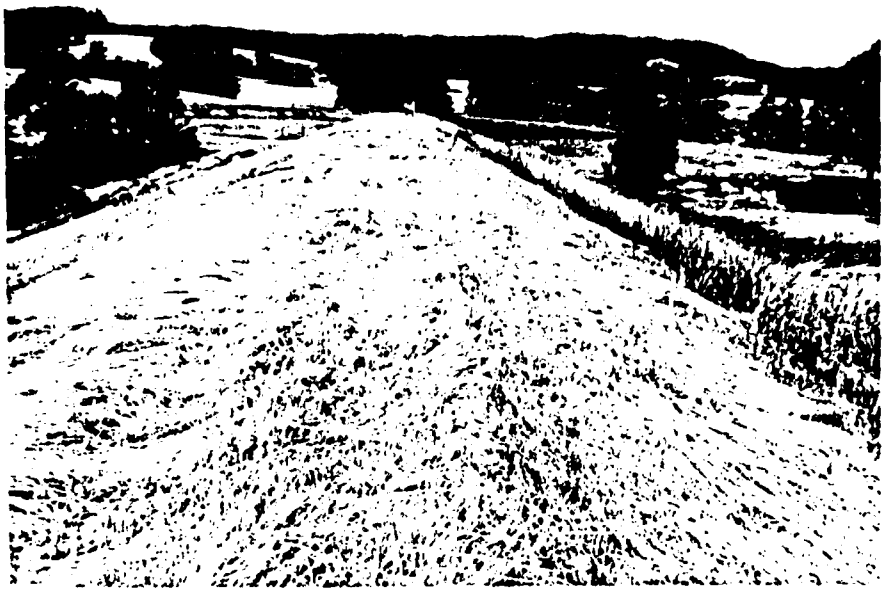


Photo 1

Photo 2

Photo 3

Photo 4

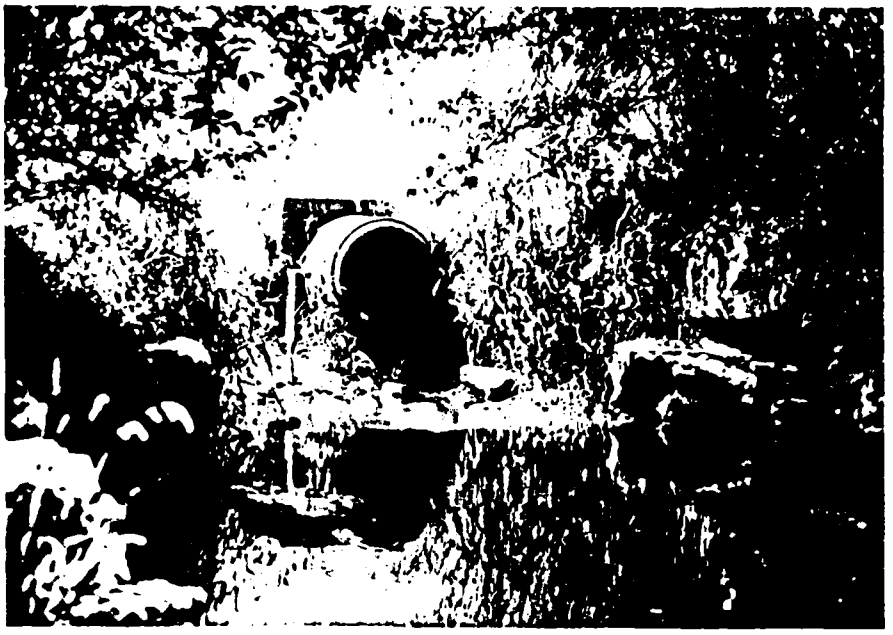


Photo 5

Photo 6

Photo 7

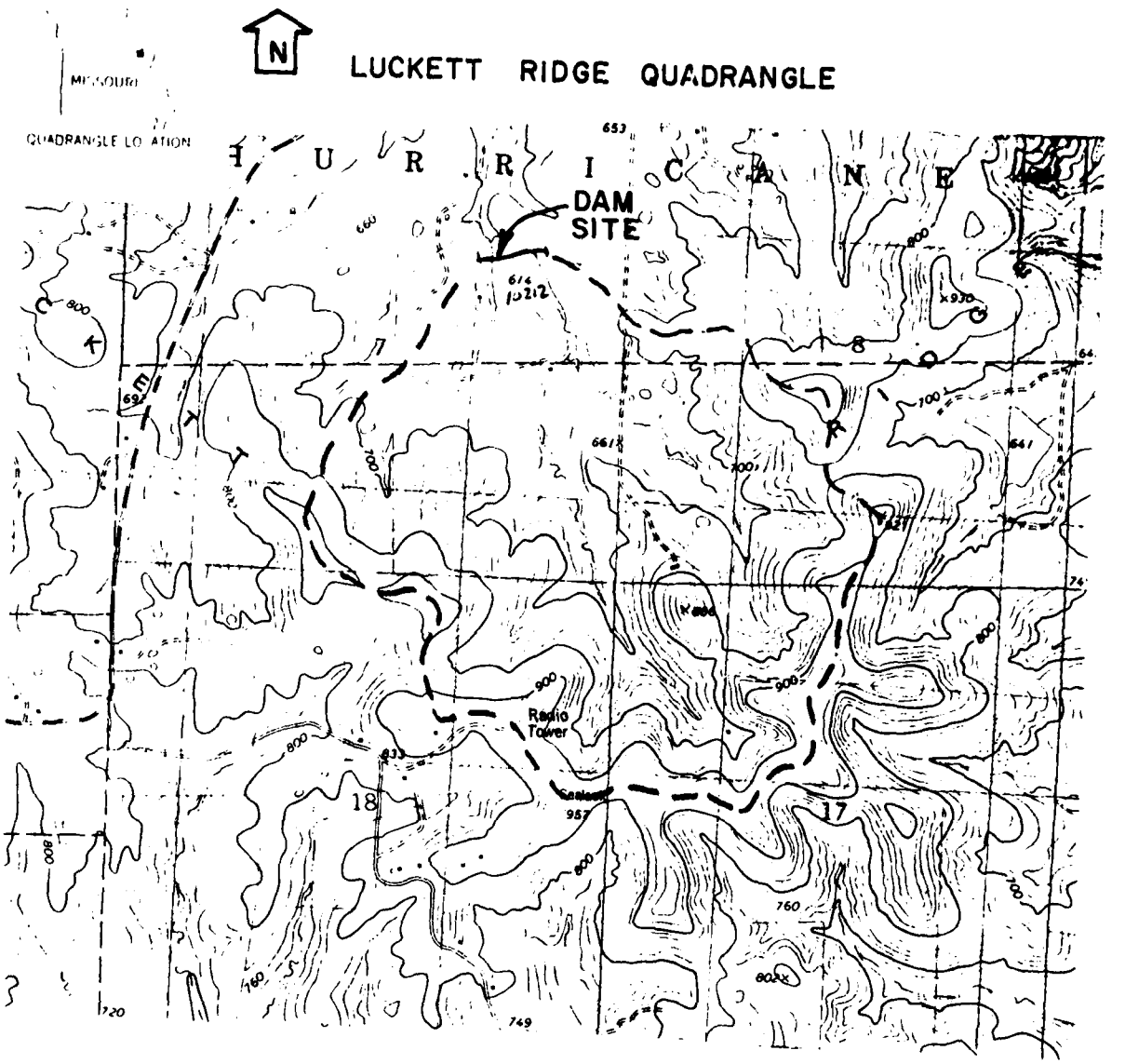
Photo 8

Photo 9

APPENDIX B

HYDROLOGIC COMPUTATIONS

PLATE I, APPENDIX B



LOST LAKE DAM (MO 10212)
DRAINAGE BASIN

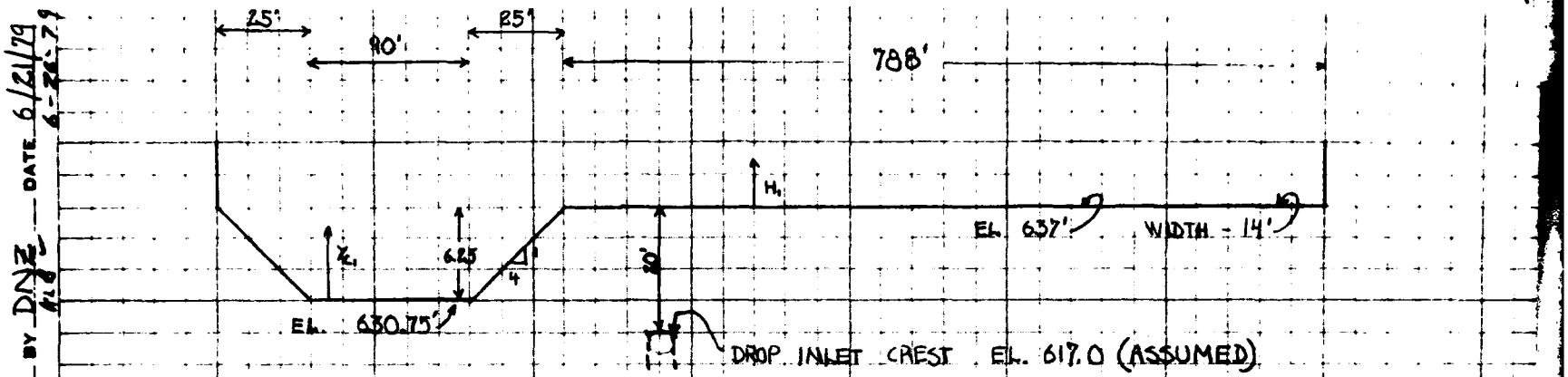
ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION ~ UTAH SHEET NO. 1 OF

LOST LAKE DAM # 10212 JOB NO. 1240

SPILLWAY AND OVERTOP RATING CURVE BY DNZ DATE 6/21/79

EC1-4



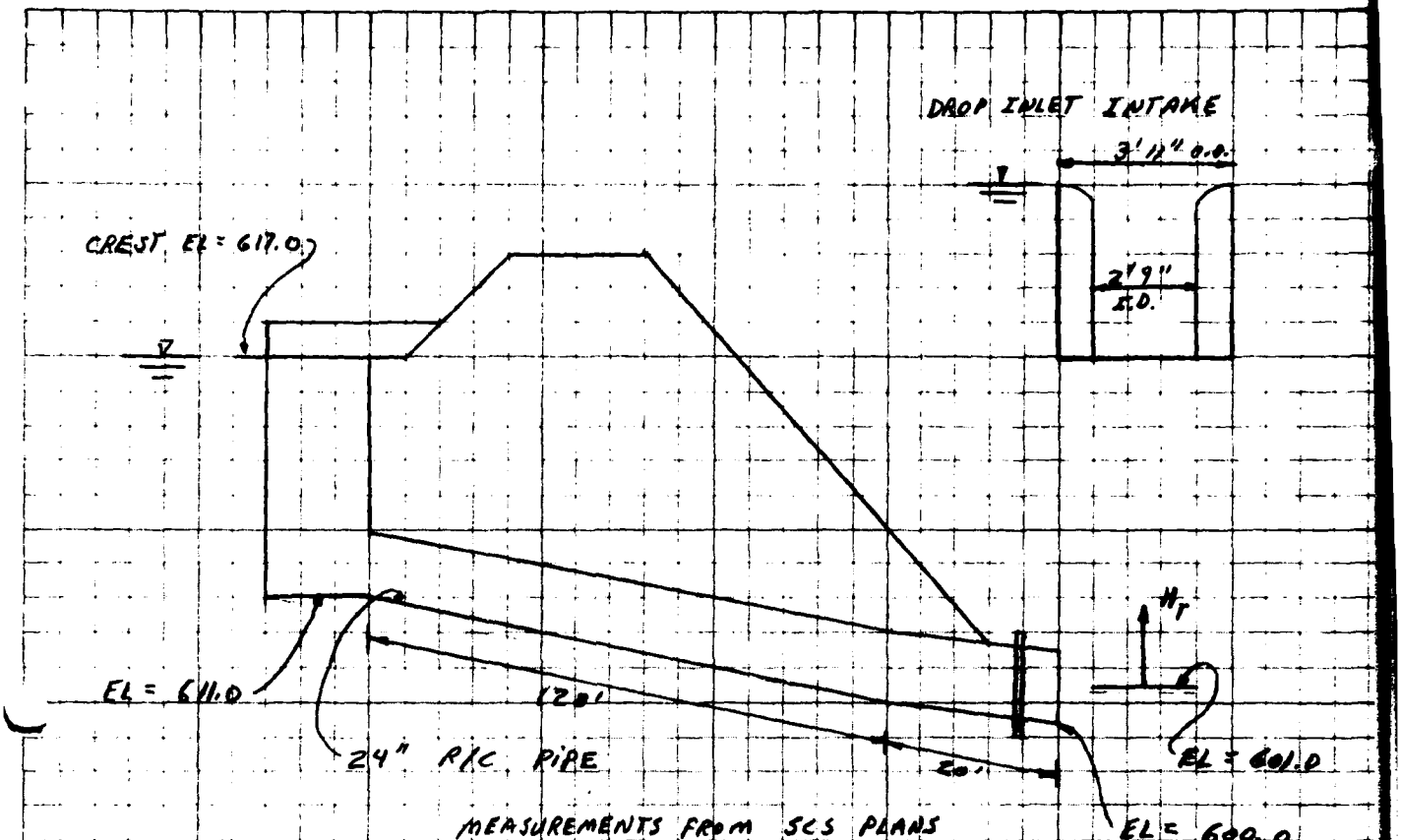
Y_{c_1}	A_{c_1}	T_{c_1}	$V_1=5.67\sqrt{D}$	$V_1^2/2g$	$Q_{c_1}=A_{c_1}V_{c_1}$	U/S W.S. = $Y_{c_1}+V_1/2g+$ 630.75	C_1	L_1	H_1	$Q_1=C_1L_1H_1^{3/2}$	$Q_T=Q_{c_1}+Q_1$
0	0	0	0	0	0	630.75	–	–	–	–	0
1	94	98	5.6	0.5	522.0	632.25	–	–	–	–	6[illegible]5
2	196	106	7.71	0.92	1511.2	633.7	–	–	–	–	1511.2
3	306	114	9.3	1.3	2842.6	635.1	–	–	–	–	2842.6
4	424	122	10.6	1.7	4481.8	636.5	–	–	–	–	4481.8
4.25	454.6	123.9	10.9	1.8	4937.2	636.8	–	–	–	–	4937.2
5	550	130	11.7	2.1	6414.4	637.9	2.64	788	.9	1776.2	8191
6.25	718.8	140	12.8	2.6	9234.6	639.6	2.63	788	2.6	8688.4	17,923.
5.5	616.	134	12.2	2.3	7488.6	638.6	2.63	788	1.6	4194.3	11,683.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 2 OF

LOST LAKE DAM (10312) JOB NO. 1340-001

PRINCIPAL SPILLWAY RATING CURVE BY KLB DATE 6-21-



MEASUREMENTS FROM SCS PLANS AND CHECKED IN THE FIELD. WHERE POSSIBLE.

PRINCIPAL SPILLWAY DISCHARGE (ASSUME NO TAILWATER EFFECT)

AT W.L. = 617.5

a) WEIR FLOW ASSUME $C = 3.03$

$L = \pi D = \pi \times 3.92 = 12.33'$

$H = 617.5 - 617.0 = 0.5$

$Q = CLH^{3/2} = 3.03 \times 12.33' \times 0.5^{3/2} = 13$ CFS

b) CHECK FOR PRESSURE FLOW: (Neglect friction in the drop pipe)

$H_T = (1 + K_e + f\frac{L}{D})\frac{v^2}{2g}$

ASSUME $\epsilon = 0.005$, $\frac{\epsilon}{D} = 0.0025 \Rightarrow f = 0.025$; Assume $K_e = 0.5$

$H_T = \left(1 + 0.5 + 0.025 \frac{144}{2}\right) \frac{V^2}{2g}$

$H_T = 3.35 \frac{V^2}{2g} \Rightarrow V = 4.38 \sqrt{H_T}$

$Q = A \cdot V = \pi \frac{D^2}{4} \times 4.38 \sqrt{H_T} = \pi \frac{4}{4} \times 4.79 \sqrt{H_T}$

$Q = 13.77 \sqrt{H_T}$

$H_T = 617.5 - 601.0 = 16.5$

$Q = 13.77 \sqrt{16.5} = 56$ CFS.

∴ AT ELEV. 617.5 WEIR FLOW CONTROLS AND Q = 13 CFS.

AT W.L. = 618.0 $H = 618.0 - 617.0 = 1.0$

a) WEIR FLOW,

$Q = CLH^{3/2} = 3.03 \times 12.83 \times 1^{3/2} = 37$ CFS.

b) PRESSURE FLOW

$Q = 13.77 \sqrt{H_T}$, $H_T = 618 - 601 = 17$.

$Q = 13.77 \sqrt{17} = 57$ CFS.

∴ AT ELEV 618, WEIR FLOW CONTROLS AND Q = 37 CFS.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 4 OF
LOST LAKE DAM (10212) JOB NO. 1240-001
PRINCIPAL SPILLWAY DISCHARGE BY KLB DATE 6-21-79

AT W.L = 619 , $H = 619 - 617 = 2$

a) WEIR FLOW

$Q = CLH^{3/2} = 3.03 \times 12.33 \times 2^{3/2} = 106$ CFS

b) PRESSURE FLOW , $H_T = 619 - 601 = 18$

$Q = 13.77\sqrt{H_T} = 13.77\sqrt{18} = 58$ CFS.

∴ AT W.L. = 619 PRESSURE FLOW CONTROLS

AND Q = 58 CFS.

ALSO FOR ALL ELEVATIONS ABOVE 619
PRESSURE FLOW WILL CONTROL
AND THE EQUATION

$Q = 13.77\sqrt{H_T}$ WILL BE USED

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI — SHEET NO. 5 OF ____

LOST LAKE DAM (10212) — JOB NO. 1240-001-

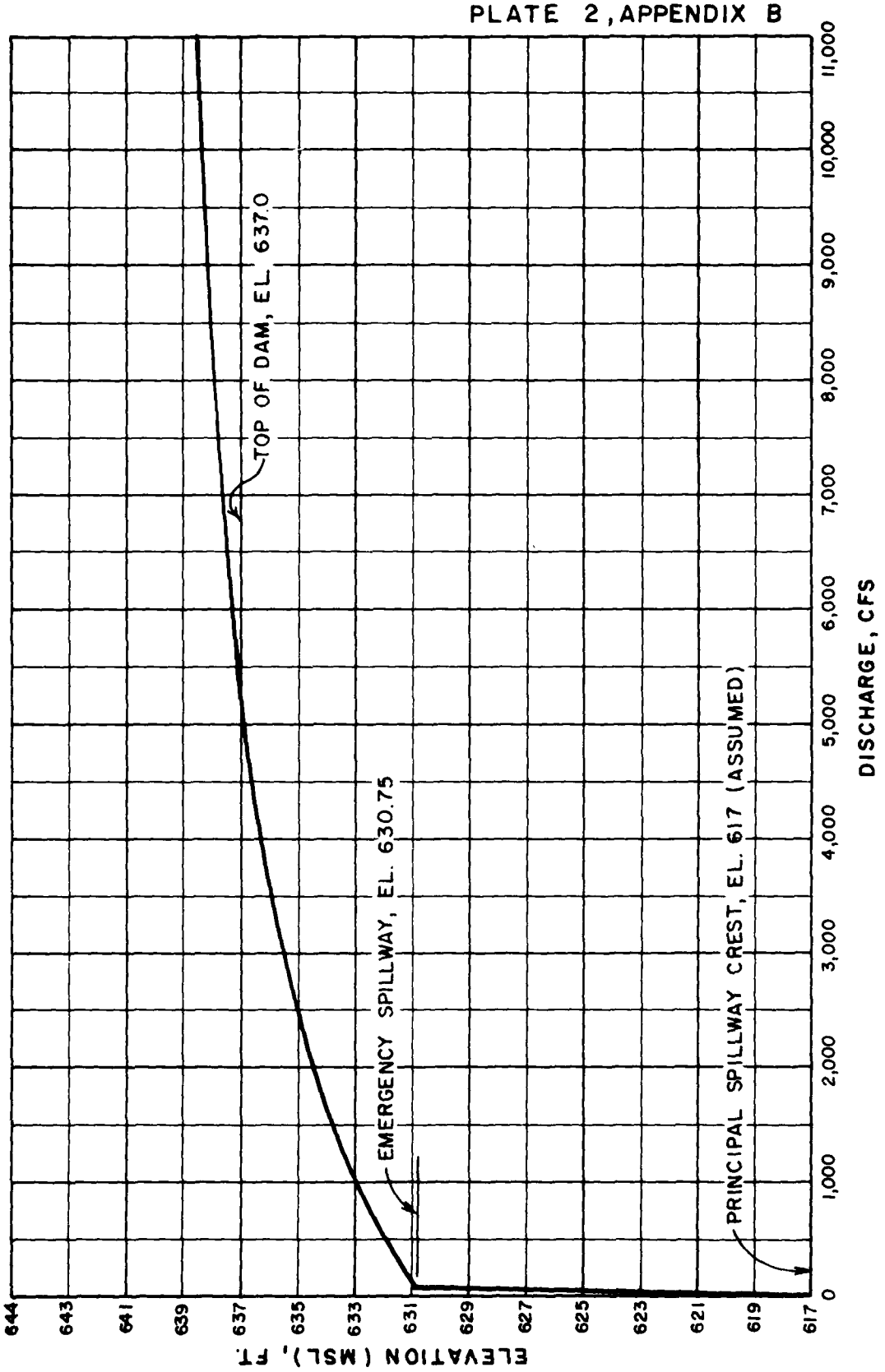
SPILLWAY AND OVERTOP RATING CURVE — BY KLB DATE 6-21-79

COMBINED RATING CURVE TABULATION

RESERVOIR WATER SURFACE ELEV.	H_e	PRINCIPAL SPILLWAY DISCHARGE $Q = 13.37 H_e^{1.5}$	EMERGENCY SPILLWAY DISCHARGE	DISCHARGE OVER TOP OF DAM	COMBINED DISCHARGE
617.0	16.0	—	—	—	0
617.5	16.5	13*	—	—	13
618.0	17.0	37*	—	—	37
619.0	18.0	58	—	—	58
623.0	22.0	65	—	—	65
628.0	27	72	—	—	72
630.75	29.75	75	—	—	75
632.25	31.25	77	522	—	599
633.7	32.7	79	1511	—	1590
635.1	34.1	80	2,843	—	2,923
636.5	35.5	82	4,482	—	4,564
636.8	35.8	82	4937	—	5,019
637.9	36.9	84	6414	1776	8,274
638.6	37.6	84	7489	4194	11,767

* WEIR FLOW CONTROLS.

PLATE 2, APPENDIX B



LOST LAKE DAM (MO. 10212)
SPILLWAY & OVERTOP RATING CURVE

ECI-4 ENGINEERING CONSULTANTS, INC.

Dam Safety Inspection - Missouri SHEET NO. 1 OF

LOST LAKE Dam - #10312 JOB NO. 1240

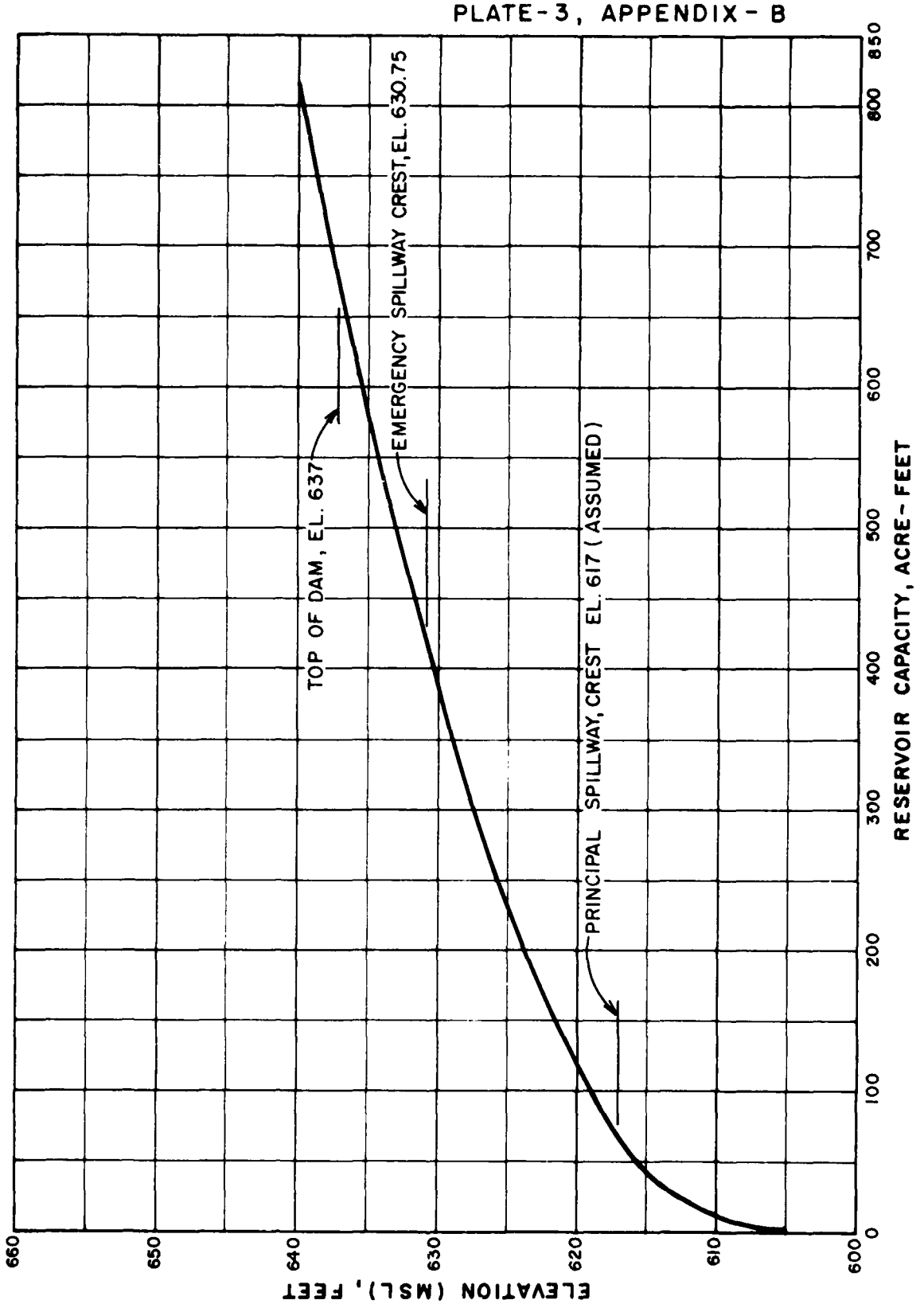
Reservoir Area Capacity BY M.R.H. D.N.E.V DATE 5-30-

LOST LAKE Dam

Reservoir Area Capacity

Elev. M.S.L. (Ft.)	Reservoir Surface Area (Acres)	Incremental Volume (Ac.-Ft.)	Total Volume (Ac.-Ft.)	Remarks
605	0	0	0	Est. Streambed at Dam
614	11	33.0	33.	W.S. as shown on Quadrangle.
617	15	38.8	72	PRINCIPAL SPILLWAY CREST EL AS SHOWN ON PLANS
620	19	50.9	123	AREA MEASURED ON USGS MAP
630.75	36	290.8	414	EMERGENCY SPILLWAY CREST
637	46	255.6	669.1	TOP OF DAM
640	51	145.4	815	AREA MEASURED ON USGS MAP.

PLATE-3, APPENDIX-B



LOST LAKE DAM (MO. 10212)
RESERVOIR CAPACITY CURVE

AD-A104 620 CONSOER TOWNSEND AND ASSOCIATES LTD ST LOUIS MO F/G 13/13
NATIONAL DAM SAFETY PROGRAM. LOST LAKE DAM (MO10212), MISSISSIP--ETC(U)
SEP 79 W G SWIFRIN DACW43-79-C-0075
UNCLASSIFIED NL

END
DATE FILMED
10-81
DTIC

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF
LOST LAKE DAM #MO 10212 JOB NO. 1240
PROBABLE MAXIMUM PRECIPITATION BY DNZ KLB DATE 6/9/79 6/22/79

LOST LAKE DAM # MO. 10212

DETERMINATION OF PMP

1. DETERMINE DRAINAGE AREA OF BASIN

D. A. = 676 ACRES

2. DETERMINE PMP INDEX RAINFALL (200 SQ. MI + 24 HRS DUR.)

LOCATION OF CENTROID BASIN

LONG. = 90°48'41" LAT. = 39°06'30"

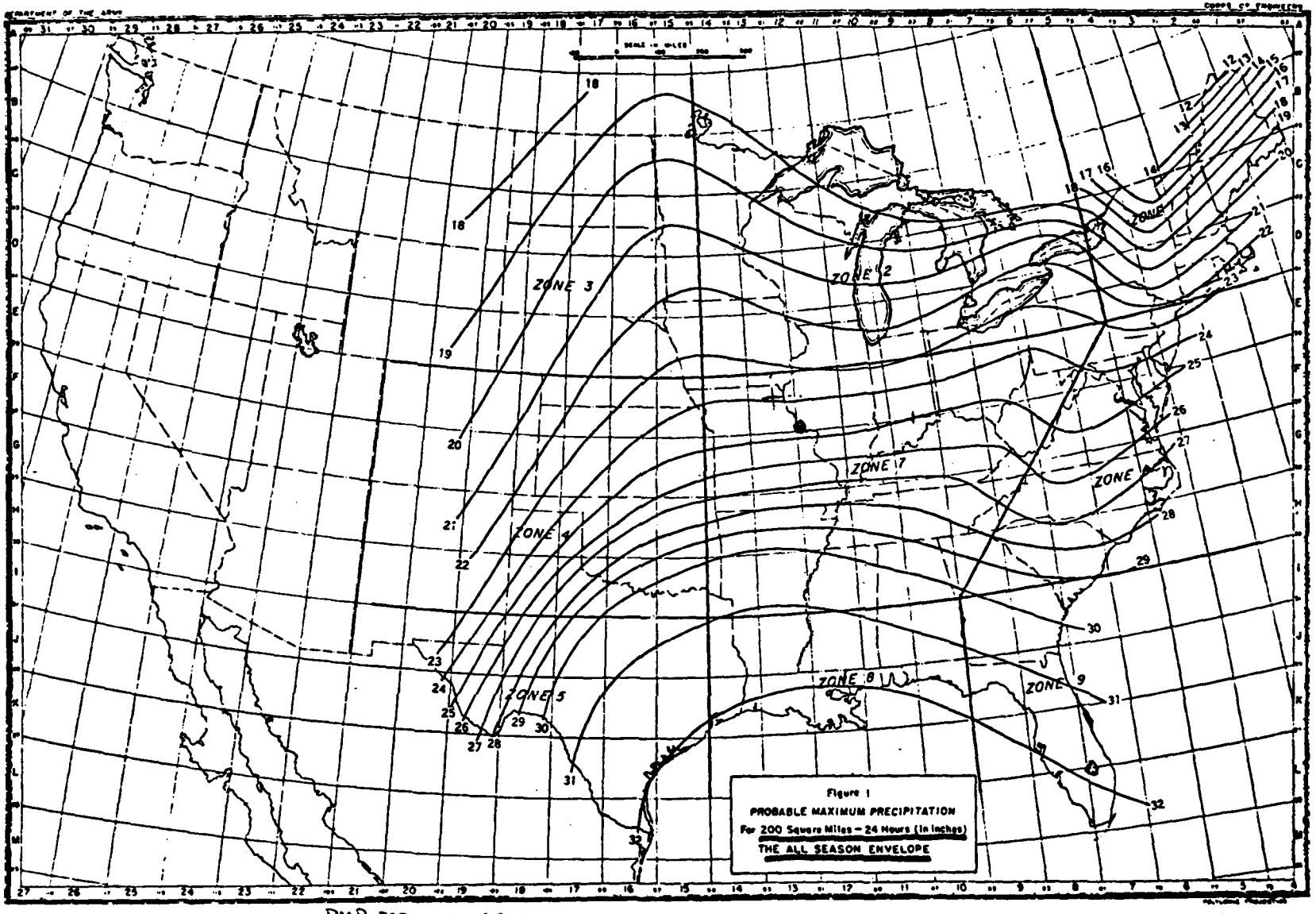
⇒ PMP = 24.7" (From Fig. 1, HMR #33)

3. DETERMINE BASIN RAINFALL IN TERMS OF PERCENTAGE OF PMP INDEX RAINFALL FOR VARIOUS DURATIONS:

LOCATION LONG. = 90°48'41" LAT. = 39°06'30"

⇒ ZONE 7

DURATION (HOURS)	PERCENT OF INDEX RAINFALL	TOTAL RAINFALL (IN.)	RAINFALL INCREMENTS (IN.)	DURATION OF INCREMENTS
6	100	24.7	24.7	6
12	120	29.6	4.9	6
24	130	32.1	2.5	12



PMP FOR 200 SQ MI +
24 HRS DURATION = 24.7"

DAM NO. 10212
LOCATION OF CENTROID
OF WATERSHED:
LAT. 39°06'30" LONG 90°48'41"

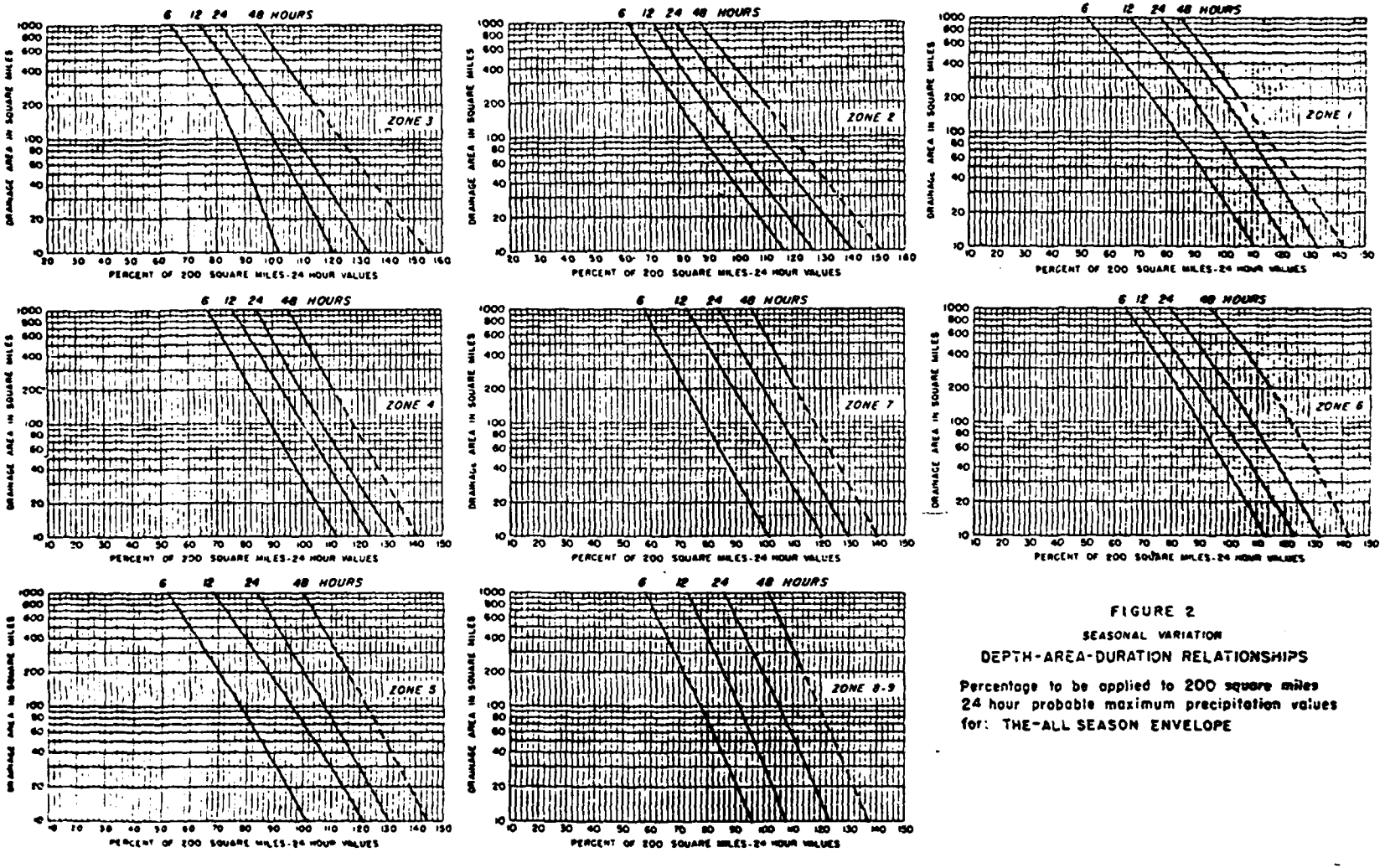


FIGURE 2

SEASONAL VARIATION

DEPTH-AREA-DURATION RELATIONSHIPS

Percentage to be applied to 200 square miles 24 hour probable maximum precipitation values for: THE-ALL SEASON ENVELOPE

ECI-4 **ENGINEERING CONSULTANTS, INC.**

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF

LOST LAKE DAM # MO. 10212 JOB NO. 1240

UNIT HYDROGRAPH PARAMETERS BY DNZ MJG DATE 6/11/79 6/22/79

1. DRAINAGE AREA, A = 676 ACRES = 1.06 SQ MI.
2. LENGTH OF STREAM, L_s = 1.33 MI = 7022 FT.
3. ELEVATION AT DRAINAGE DIVIDE ALONG LONGEST STREAM.
   H_1 = 945 Ft.
4. RESERVOIR ELEVATION AT SPILLWAY CREST, H_2 = 617 Ft.
5. DIFFERENCE IN ELEVATION, ΔH = 328 Ft.
6. AVERAGE SLOPE OF STREAM = $\frac{\Delta H}{L_s} = \frac{328}{7022} = 4.67\%$
7. TIME OF CONCENTRATION:
   a) BY KIRPICH FORMULA:
   $$T_c = \left(\frac{11.9 \times L^3}{\Delta H}\right)^{0.385} = \left(\frac{11.9 \times 1.33^3}{331}\right)^{0.385} = 0.39 \text{ HR}$$
   b) BY VELOCITY ESTIMATE: AVG VEL = 4.0 FPS
   $$T_c = \frac{L_s}{V} = \frac{7022}{4(60 \times 60)} = 0.49 \text{ HR}$$
   USE T_c = 0.39
8. LAG TIME, $L_t = 0.6 \times 0.39 = 0.23$
9. UNIT DURATION, $D \leq \frac{L_t}{3} = \frac{0.23}{3} = 0.077 < 0.083$
   USE D = 0.083
10. TIME TO PEAK, $T_p = \frac{D}{2} + L_t = \frac{0.083}{2} + 0.23 = 0.272$
11. PEAK DISCHARGE, $q_p = \frac{484 A}{T_p} = \frac{484 (1.06)}{0.272}$
    q_p = 1886 CFS

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION/MISSOURI — SHEET NO. 1 OF
LOST LAKE DAM (MO. 10212) — JOB NO. 1240-001
HYDROLOGIC SOIL GROUP & CURVE NUMBER — BY MAS DATE 7/11/78

LOST LAKE DAM (MO. 10212)

DETERMINATION OF HYDROLOGIC SOIL GROUP & SCS CURVE NUMBER

1. Watershed soils consist of group B and C soils. Soil group B seems to be predominant. Assume soil group B for the entire watershed.

2. Most of the watershed is wooded and covered with grass. Assume hydrologic condition of the watershed to be "Fair" for infiltration purpose

Thus CN = 60 for AMC-II & group B soil.

$\Rightarrow$ CN = 78 for AMC-III & group B soil.

ECI-4 ENGINEERING CONSULTANTS, INC.

DAM SAFETY INSPECTION - MISSOURI SHEET NO. 1 OF
LOST LAKE DAM - (#10212) JOB NO. 1240-001
100 YR FLOOD FROM REGRESSION EQUATION BY KLB MAS DATE 6-22-2.

LOST LAKE DAM

100 YR FLOOD FROM REGRESSION EQUATION.

REGRESSION EQUATION FOR 100-YR FLOOD FOR MISSOURI:

$$Q_{100} = 85.1\ A^{0.934}\ A^{-.402}\ S^{0.576}$$

WHERE

A = DRAINAGE AREA IN SQ. MI.

S = MAIN CHANNEL SLOPE FT/MI (AVG. SLOPE BETWEEN 0.1 L AND 0.85 L)

FOR LOST LAKE DAM:

A = 1.06 SQ. MI.

S = 142 FT/MI.

$$Q_{100} = 85.1\ (1.06)^{0.934}\ (1.06)^{-0.402}\ (142)^{0.576}$$

$$Q_{100} = 1560\ \text{CFS.}$$

HEC1DB INPUT DATA

```
**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 197
  LAST MODIFICATION  26 FE  79
**********

     1                A
     2                A                              DAM SAFETY INSPECTION - MISSOURI
     3                A                                LOST LAKE DAM (10212)
     4                A                        PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING
     5                I     300        0        5        0        0        0        0        0        0        0
     6                IT      5
     7                J       1                 1
     8                JT      1      0.5
     9                K       1    10212                                        1
    10                K1   INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS
    11                P       1        2     1.06                1.06      1.0
    12                P               24.7      100      125      130
    13                P                                                      -1      -78
    14                P2              0.23
    15                P       0                 1
    16                K       1    10212                                   2        1
    17                K1   ROUTE HYDROGRAPH THROUGH LOST LAKE DAM (10212)
    18                K                                          1        1
    19                Y1      1                                                    -617       -1
    20                Y2    617     617.5     618.0     618.0     623.0     628.0    630.75    632.25    633.7     635.1
    21                Y3  636.5     636.9     637       637.9     638.5
    22                Y4      0        17        37        58        85        72        75       509      1590      2923
    23                Y5   4564      5019      5495      8274     11767
    24                Y6      0        33        72       123       414       669       815
    25                Y7    605       614       617       620    632.75       637       643
    26                Y8    617
    27                Y9    637
    28                K       9
```

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	10212
ROUTE HYDROGRAPH TO	10212
END OF NETWORK	

INFLOW PMF AND ONE-HALF PMF HYDROGRAPHS

****
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION JULY 1978
LAST MODIFICATION 26 FEB 79
****

RUN DATE= 79/07/13.
TIME= 11.47.33.

DAM SAFETY INSPECTION - MISSOURI
[illegible] LAKE DAM (11710)
PMF AND 50 PERCENT PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NU	NPP	NMIN	IDAY	IHR	[illegible]	METRC	IPLT	IPRT	NSTAN
300		5	0	0	0	0	0	0	0
			JOPER	NWT	LROPT	TRACE			
			5	0	0	0			

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 2 LRTIO= 1
RTIOS= 1.00 .50

****

[illegible]-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS

ISTAG	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10212	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	0	1.06	0.00	1.06	1.06	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.70	24.70	100.00	120.00	130.00	[illegible]	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	[illegible]	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	73.00	0.00

CURVE NO = 0.00 [illegible] -1.00 EFFECT = 73.00

UNIT HYDROGRAPH DATA
[illegible] 0.0 [illegible]

RECESSION DATA
STRTQ [illegible]

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q
1.01	.05	1	.01	0.00	.01	0.	1.01	12.55	151	.21	.19	.02	1440.
1.01	.10	2	.01	0.00	.01	0.	1.01	13.00	152	.21	.19	.02	1478.
1.01	.15	3	.01	0.00	.01	0.	1.01	13.05	153	.21	.19	.02	1504.
1.01	.20	4	.01	0.00	.01	0.	1.01	13.10	154	.21	.19	.02	1522.
1.01	.25	5	.01	0.00	.01	0.	1.01	13.15	155	.21	.19	.02	1535.
1.01	.30	6	.01	0.00	.01	0.	1.01	13.20	156	.21	.19	.01	1545.
1.01	.35	7	.01	0.00	.01	0.	1.01	13.25	157	.25	.23	.02	1568.
1.01	.40	8	.01	0.00	.01	0.	1.01	13.30	158	.25	.23	.02	1624.
1.01	.45	9	.01	0.00	.01	0.	1.01	13.35	159	.25	.23	.02	1702.
1.01	.50	10	.01	0.00	.01	0.	1.01	13.40	160	.25	.23	.01	1773.
1.01	.55	11	.01	0.00	.01	0.	1.01	13.45	161	.25	.23	.01	1825.
1.01	1.00	12	.01	0.00	.01	0.	1.01	13.50	162	.25	.23	.01	1857.
1.01	1.05	13	.01	0.00	.01	0.	1.01	13.55	163	.25	.23	.01	1879.
1.01	1.10	14	.01	0.00	.01	0.	1.01	14.00	164	.25	.23	.01	1894.
1.01	1.15	15	.01	0.00	.01	0.	1.01	14.05	165	.25	.23	.01	1904.
1.01	1.20	16	.01	0.00	.01	0.	1.01	14.10	166	.25	.24	.01	1912.
1.01	1.25	17	.01	0.00	.01	0.	1.01	14.15	167	.25	.24	.01	1918.
1.01	1.30	18	.01	0.00	.01	0.	1.01	14.20	168	.25	.24	.01	1924.
1.01	1.35	19	.01	0.00	.01	0.	1.01	14.25	169	.31	.30	.01	1951.
1.01	1.40	20	.01	0.00	.01	0.	1.01	14.30	170	.31	.30	.01	2031.
1.01	1.45	21	.01	0.00	.01	0.	1.01	14.35	171	.31	.30	.01	2146.
1.01	1.50	22	.01	0.00	.01	0.	1.01	14.40	172	.31	.30	.01	2251.
1.01	1.55	23	.01	0.00	.01	0.	1.01	14.45	173	.31	.30	.01	2327.
1.01	2.00	24	.01	0.00	.01	0.	1.01	14.50	174	.31	.30	.01	2371.
1.01	2.05	25	.01	0.00	.01	0.	1.01	14.55	175	.31	.30	.01	2401.
1.01	2.10	26	.01	0.00	.01	0.	1.01	15.00	176	.31	.30	.01	2420.
1.01	2.15	27	.01	0.00	.01	0.	1.01	15.05	177	.31	.30	.01	2432.
1.01	2.20	28	.01	0.00	.01	0.	1.01	15.10	178	.31	.30	.01	2441.
1.01	2.25	29	.01	0.00	.01	0.	1.01	15.15	179	.31	.30	.01	2448.
1.01	2.30	30	.01	0.00	.01	0.	1.01	15.20	180	.31	.30	.01	2453.
1.01	2.35	31	.01	0.00	.01	0.	1.01	15.25	181	.19	.18	.00	2413.
1.01	2.40	32	.01	0.00	.01	0.	1.01	15.30	182	.38	.37	.01	2334.
1.01	2.45	33	.01	0.00	.01	0.	1.01	15.35	183	.38	.37	.01	2351.
1.01	2.50	34	.01	0.00	.01	0.	1.01	15.40	184	.56	.55	.01	2562.
1.01	2.55	35	.01	0.00	.01	0.	1.01	15.45	185	.68	.64	.01	3006.
1.01	3.00	36	.01	0.00	.01	0.	1.01	15.50	186	1.40	1.36	.03	3953.
1.01	3.05	37	.01	0.00	.01	0.	1.01	15.55	187	2.63	2.59	.04	6083.
1.01	3.10	38	.01	0.00	.01	0.	1.01	16.00	188	1.03	1.02	.01	8961.
1.01	3.15	39	.01	0.00	.01	0.	1.01	16.05	189	.66	.65	.01	10568.
1.01	3.20	40	.01	0.00	.01	0.	1.01	16.10	190	.56	.56	.01	10153.
1.01	3.25	41	.01	0.00	.01	0.	1.01	16.15	191	.38	.37	.00	8546.
1.01	3.30	42	.01	.00	.01	0.	1.01	16.20	192	.38	.37	.00	7765.
1.01	3.35	43	.01	.00	.01	0.	1.01	16.25	193	.29	.28	.00	5814.
1.01	3.40	44	.01	.00	.01	0.	1.01	16.30	194	.29	.29	.00	4379.
1.01	3.45	45	.01	.00	.01	1.	1.01	16.35	195	.29	.29	.00	3632.
1.01	3.50	46	.01	.00	.01	2.	1.01	16.40	196	.29	.29	.00	3135.
1.01	3.55	47	.01	.00	.01	3.	1.01	16.45	197	.29	.29	.00	2819.
1.01	4.00	48	.01	.00	.01	4.	1.01	16.50	198	.29	.29	.00	2631.
1.01	4.05	49	.01	.00	.01	5.	1.01	16.55	199	.29	.29	.00	2517.
1.01	4.10	50	.01	.00	.01	6.	1.01	17.00	200	.29	.29	.00	2448.
1.01	4.15	51	.01	.00	.01	6.	1.01	17.05	201	.29	.29	.00	2401.
1.01	4.20	52	.01	.00	.01	7.	1.01	17.10	202	.29	.29	.00	2369.
1.01	4.25	53	.01	.00	.01	8.	1.01	17.15	203	.29	.29	.00	2354.
1.01	4.30	54	.01	.00	.01	9.	1.01	17.20	204	.29	.29	.00	2349.
1.01	4.35	55	.01	.00	.01	10.	1.01	17.25	205	.23	.22	.00	2322.
1.01	4.40	56	.01	.00	.01	11.	1.01	17.30	206	.23	.22	.00	2242.

1.01	4.45	57	.01	.00	.01	12.	1.01	17.15	207	.23	.22	.00	2128.
1.01	4.50	58	.01	.00	.01	13.	1.01	17.20	208	.23	.22	.00	2023.
1.01	4.55	59	.01	.00	.01	14.	1.01	17.25	209	.23	.22	.00	1949.
1.01	5.00	60	.01	.00	.01	15.	1.01	17.30	210	.23	.22	.00	1907.
1.01	5.05	61	.01	.00	.01	16.	1.01	17.35	211	.23	.22	.00	1881.
1.01	5.10	62	.01	.00	.01	17.	1.01	17.40	212	.23	.22	.00	1866.
1.01	5.15	63	.01	.00	.01	18.	1.01	17.45	213	.23	.22	.00	1857.
1.01	5.20	64	.01	.00	.01	18.	1.01	17.50	214	.23	.22	.00	1851.
1.01	5.25	65	.01	.00	.01	19.	1.01	17.55	215	.23	.22	.00	1848.
1.01	5.30	66	.01	.00	.01	20.	1.01	18.00	216	.23	.22	.00	1846.
1.01	5.35	67	.01	.00	.01	21.	1.01	18.05	217	.02	.02	.00	1769.
1.01	5.40	68	.01	.00	.01	22.	1.01	18.10	218	.02	.02	.00	1506.
1.01	5.45	69	.01	.00	.01	22.	1.01	18.15	219	.02	.02	.00	1124.
1.01	5.50	70	.01	.00	.01	23.	1.01	18.20	220	.02	.02	.00	773.
1.01	5.55	71	.01	.00	.01	24.	1.01	18.25	221	.02	.02	.00	527.
1.01	6.00	72	.01	.00	.01	25.	1.01	18.30	222	.02	.02	.00	386.
1.01	6.05	73	.07	.02	.05	31.	1.01	18.35	223	.02	.02	.00	299.
1.01	6.10	74	.07	.02	.05	51.	1.01	18.40	224	.02	.02	.00	247.
1.01	6.15	75	.07	.02	.05	82.	1.01	18.45	225	.02	.02	.00	215.
1.01	6.20	76	.07	.02	.04	114.	1.01	18.50	226	.02	.02	.00	196.
1.01	6.25	77	.07	.03	.04	149.	1.01	18.55	227	.02	.02	.00	184.
1.01	6.30	78	.07	.03	.04	164.	1.01	19.00	228	.02	.02	.00	177.
1.01	6.35	79	.07	.03	.04	193.	1.01	19.05	229	.02	.02	.00	172.
1.01	6.40	80	.07	.03	.04	206.	1.01	19.10	230	.02	.02	.00	170.
1.01	6.45	81	.07	.03	.04	218.	1.01	19.15	231	.02	.02	.00	168.
1.01	6.50	82	.07	.03	.04	228.	1.01	19.20	232	.02	.02	.00	168.
1.01	6.55	83	.07	.03	.03	241.	1.01	19.25	233	.02	.02	.00	168.
1.01	7.00	84	.07	.04	.03	253.	1.01	19.30	234	.02	.02	.00	168.
1.01	7.05	85	.07	.04	.03	264.	1.01	19.35	235	.02	.02	.00	168.
1.01	7.10	86	.07	.04	.03	274.	1.01	19.40	236	.02	.02	.00	168.
1.01	7.15	87	.07	.04	.03	284.	1.01	19.45	237	.02	.02	.00	168.
1.01	7.20	88	.07	.04	.03	294.	1.01	19.50	238	.02	.02	.00	168.
1.01	7.25	89	.07	.04	.03	304.	1.01	19.55	239	.02	.02	.00	168.
1.01	7.30	90	.07	.04	.03	311.	1.01	20.00	240	.02	.02	.00	168.
1.01	7.35	91	.07	.04	.03	316.	1.01	20.05	241	.02	.02	.00	168.
1.01	7.40	92	.07	.04	.03	327.	1.01	20.10	242	.02	.02	.00	168.
1.01	7.45	93	.07	.04	.03	336.	1.01	20.15	243	.02	.02	.00	168.
1.01	7.50	94	.07	.04	.02	341.	1.01	20.20	244	.02	.02	.00	168.
1.01	7.55	95	.07	.04	.02	348.	1.01	20.25	245	.02	.02	.00	168.
1.01	8.00	96	.07	.05	.02	354.	1.01	20.30	246	.02	.02	.00	168.
1.01	8.05	97	.07	.05	.02	360.	1.01	20.35	247	.02	.02	.00	168.
1.01	8.10	98	.07	.05	.02	366.	1.01	20.40	248	.02	.02	.00	168.
1.01	8.15	99	.07	.05	.02	371.	1.01	20.45	249	.02	.02	.00	168.
1.01	8.20	100	.07	.05	.02	376.	1.01	20.50	250	.02	.02	.00	168.
1.01	8.25	101	.07	.05	.02	382.	1.01	20.55	251	.02	.02	.00	168.
1.01	8.30	102	.07	.05	.02	387.	1.01	21.00	252	.02	.02	.00	168.
1.01	8.35	103	.07	.05	.02	391.	1.01	21.05	253	.02	.02	.00	168.
1.01	8.40	104	.07	.05	.02	396.	1.01	21.10	254	.02	.02	.00	168.
1.01	8.45	105	.07	.05	.02	400.	1.01	21.15	255	.02	.02	.00	168.
1.01	8.50	106	.07	.05	.02	404.	1.01	21.20	256	.02	.02	.00	168.
1.01	8.55	107	.07	.05	.02	408.	1.01	21.25	257	.02	.02	.00	168.
1.01	9.00	108	.07	.05	.02	412.	1.01	21.30	258	.02	.02	.00	168.
1.01	9.05	109	.07	.05	.02	416.	1.01	21.35	259	.02	.02	.00	168.
1.01	9.10	110	.07	.05	.02	420.	1.01	21.40	260	.02	.02	.00	168.
1.01	9.15	111	.07	.05	.02	425.	1.01	21.45	261	.02	.02	.00	168.
1.01	9.20	112	.07	.05	.02	429.	1.01	21.50	262	.02	.02	.00	168.
1.01	9.25	113	.07	.05	.02	433.	1.01	21.55	263	.02	.02	.00	168.
1.01	9.30	114	.07	.05	.01	435.	1.01	22.00	264	.02	.02	.00	168.
1.01	9.35	115	.07	.05	.01	436.	1.01	22.05	265	.02	.02	.00	168.
1.01	9.40	116	.07	.05	.01	439.	1.01	22.10	266	.02	.02	.00	168.

1.01	9.45	117	.07	.05	.01	441.	1.01	22.19	267	.02	.02	.00	168.
1.01	9.50	116	.07	.06	.01	444.	1.01	22.20	268	.02	.02	.00	168.
1.01	9.55	119	.07	.06	.01	447.	1.01	22.25	269	.02	.02	.00	168.
1.01	10.00	120	.07	.06	.01	449.	1.01	22.30	270	.02	.02	.00	168.
1.01	10.05	121	.07	.06	.01	452.	1.01	22.35	271	.02	.02	.00	168.
1.01	10.10	122	.07	.06	.01	454.	1.01	22.40	272	.02	.02	.00	168.
1.01	10.15	123	.07	.06	.01	456.	1.01	22.45	273	.02	.02	.00	168.
1.01	10.20	124	.07	.06	.01	459.	1.01	22.50	274	.02	.02	.00	168.
1.01	10.25	125	.07	.06	.01	461.	1.01	22.55	275	.02	.02	.00	168.
1.01	10.30	126	.07	.06	.01	463.	1.01	23.00	276	.02	.02	.00	168.
1.01	10.35	127	.07	.06	.01	465.	1.01	23.05	277	.02	.02	.00	168.
1.01	10.40	128	.07	.06	.01	467.	1.01	23.10	278	.02	.02	.00	168.
1.01	10.45	129	.07	.06	.01	469.	1.01	23.15	279	.02	.02	.00	168.
1.01	10.50	130	.07	.06	.01	471.	1.01	23.20	280	.02	.02	.00	168.
1.01	10.55	131	.07	.06	.01	472.	1.01	23.25	281	.02	.02	.00	168.
1.01	11.00	132	.07	.06	.01	474.	1.01	23.30	282	.02	.02	.00	168.
1.01	11.05	133	.07	.06	.01	476.	1.01	23.35	283	.02	.02	.00	168.
1.01	11.10	134	.07	.06	.01	477.	1.01	23.40	284	.02	.02	.00	168.
1.01	11.15	135	.07	.06	.01	479.	1.01	23.45	285	.02	.02	.00	168.
1.01	11.20	136	.07	.06	.01	481.	1.01	23.50	286	.02	.02	.00	168.
1.01	11.25	137	.07	.06	.01	482.	1.01	23.55	287	.02	.02	.00	168.
1.01	11.30	138	.07	.06	.01	484.	1.02	0.00	288	.02	.02	.00	168.
1.01	11.35	139	.07	.06	.01	485.	1.02	.05	289	0.00	0.00	0.00	140.
1.01	11.40	140	.07	.06	.01	486.	1.02	.10	290	0.00	0.00	0.00	114.
1.01	11.45	141	.07	.06	.01	488.	1.02	.15	291	0.00	0.00	0.00	96.
1.01	11.50	142	.07	.06	.01	489.	1.02	.20	292	0.00	0.00	0.00	81.
1.01	11.55	143	.07	.06	.01	490.	1.02	.25	293	0.00	0.00	0.00	36.
1.01	12.00	144	.07	.06	.01	492.	1.02	.30	294	0.00	0.00	0.00	22.
1.01	12.05	145	.21	.18	.02	536.	1.02	.35	295	0.00	0.00	0.00	13.
1.01	12.10	146	.21	.18	.02	586.	1.02	.40	296	0.00	0.00	0.00	8.
1.01	12.15	147	.21	.18	.02	925.	1.02	.45	297	0.00	0.00	0.00	5.
1.01	12.20	148	.21	.19	.02	1134.	1.02	.50	298	0.00	0.00	0.00	3.
1.01	12.25	149	.21	.19	.02	1291.	1.02	.55	299	0.00	0.00	0.00	2.
1.01	12.30	150	.21	.19	.02	1381.	1.02	1.00	300	0.00	0.00	0.00	1.
									SUM	32.11	23.96	3.15	237599.
										(.810)	(736.)	(80.)	(6728.05)

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10568.	2701.	625.	192.	237573.
CMS	299.	76.	18.	22.	6727.
INCHES		23.70	27.55	28.96	28.96
MM		602.00	739.50	735.50	735.50
AC-FT		1339.	1636.	1636.	1636.
THOUS CU M		1652.	2018.	2018.	2018.

HYDROGRAPH AT STA 10212 FOR PLAN 1, RTIO 1

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	2.	3.	4.	5.	5.
6.	7.	8.	9.	10.	11.	12.	13.	14.	15.
16.	17.	18.	18.	19.	20.	21.	22.	22.	23.
24.	25.	31.	51.	82.	114.	142.	164.	183.	200.
215.	228.	241.	253.	264.	274.	284.	294.	303.	311.
319.	327.	334.	341.	348.	354.	360.	366.	371.	377.
382.	387.	391.	536.	400.	404.	408.	412.	416.	420.

423.	425.	430.	433.	436.	439.	441.	444.	447.	449.
452.	454.	456.	459.	461.	463.	465.	467.	469.	471.
472.	474.	476.	477.	479.	481.	482.	484.	485.	486.
488.	489.	490.	492.	536.	696.	925.	1138.	1291.	1381.
1440.	1478.	1504.	1522.	1535.	1545.	1569.	1624.	1702.	1773.
1825.	1857.	1879.	1894.	1904.	1912.	1919.	1924.	1951.	2031.
2146.	2251.	2327.	2371.	2401.	2420.	2432.	2441.	2445.	2453.
2413.	2334.	2351.	2562.	3000.	[illegible]	[illegible]	8961.	10558.	10153.
8546.	6769.	5414.	4579.	3632.	3135.	2819.	2631.	2517.	2448.
2481.	2369.	2354.	2349.	2322.	2242.	2128.	2023.	1949.	1907.
1881.	1866.	1857.	1851.	1848.	1846.	1769.	1536.	1124.	773.
527.	386.	299.	247.	215.	196.	184.	177.	172.	170.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	168.	168.	168.
168.	168.	168.	168.	168.	168.	168.	166.	168.	168.
168.	168.	166.	168.	168.	168.	168.	166.	160.	134.
96.	61.	34.	22.	13.	8.	5.	3.	2.	1.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	10566.	2701.	825.	792.	237573.
CMS	299.	77.	23.	22.	6727.
INCHES		23.72	28.96	28.96	28.96
MM		602.30	735.56	735.56	735.56
AC-FT		1339.	1636.	1636.	1636.
THOUS CU M		1652.	2018.	2018.	2018.

HYDROGRAPH AT STA 10012 FOR PLAN 1, RTIO 2

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	1.	1.	1.	2.	2.	3.
3.	4.	4.	5.	5.	6.	6.	7.	7.	7.
8.	8.	9.	9.	10.	10.	10.	11.	11.	12.
12.	12.	15.	25.	41.	57.	71.	82.	91.	100.
107.	114.	120.	126.	132.	137.	142.	147.	151.	155.
159.	163.	167.	170.	174.	177.	180.	183.	186.	189.
191.	193.	196.	198.	200.	202.	204.	206.	208.	210.
212.	213.	215.	216.	218.	219.	221.	222.	223.	225.
226.	227.	228.	229.	230.	231.	232.	233.	234.	235.
236.	237.	238.	239.	240.	240.	241.	242.	243.	243.
244.	245.	245.	246.	269.	348.	463.	569.	645.	691.
720.	739.	752.	761.	767.	773.	794.	812.	851.	887.
913.	929.	939.	947.	952.	956.	959.	962.	975.	1016.
1073.	1125.	1163.	1186.	1200.	1210.	1216.	1221.	1224.	1227.
1207.	1167.	1176.	1281.	1503.	1976.	3041.	4460.	5284.	5376.
4273.	3364.	2707.	2190.	1813.	1567.	1409.	1316.	1259.	1224.
1202.	1185.	1177.	1174.	1161.	1121.	1064.	1011.	975.	954.
941.	933.	928.	926.	924.	923.	884.	753.	562.	386.
263.	193.	150.	123.	117.	98.	92.	88.	86.	85.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	84.	84.
84.	84.	84.	84.	84.	84.	84.	84.	60.	7.

98.	30.	18.	11.	7.	4.	2.	1.	1.	0.

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5284.	1950.	412.	396.	118786.
CMS	150.	56.	12.	11.	3364.
INCHES		11.85	14.48	14.48	14.48
MM		301.00	367.75	367.75	367.75
AC-FT		670.	818.	818.	818.
THOUS CU M		826.	1009.	1009.	1009.

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HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH LOST LAKE DAM (10212)

ISTAG	ICOMP	IECON	ITAPE	JPLT	JRPT	INAME	ISTAGE	IAUTO
10212	1	0	0	2	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAVE	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-617.	-1

STAGE	617.00	617.50	617.00	618.00	622.00	628.00	630.75	632.25	633.70	635.10
	636.50	636.60	637.00	637.90	638.60					
FLOW	0.00	13.00	37.00	58.00	65.00	72.00	75.00	599.00	1590.00	2983.00
	4564.00	5219.00	5495.00	8274.00	11767.00					
CAPACITY=	0.	33.	72.	123.	414.	669.	815.			
ELEVATION=	605.	614.	617.	620.	631.	637.	640.			

CREL	SPWID	COOL	EXPL	ELEVL	COOL	CAREA	EXPL
617.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
637.0	0.0	0.0	0.

STATION 10212. PLAN 1. RATIO 1

END-OF-PERIOD HYDROGRAPH ORDINATES

OUTFLOW

0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.	0.	0.	0.	0.
1.	1.	2.	2.	2.	2.	2.	1.	1.	1.
3.	3.	4.	4.	5.	6.	7.	9.	10.	12.
19.	19.	23.	28.	32.	37.	39.	41.	43.	45.

SUMMARY OF PMF AND ONE-HALF PMF FLOOD ROUTING

PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO FLOWS	
				RATIO 1 1.00	RATIO 2 .70
HYDROGRAPH AT	10212	1.06	1	1356.	521.
		(2.75)		(295.27)(	149.62)(
ROUTED TO	10212	1.06	1	7620.	1903.
		(2.75)		(215.78)(	53.89)(

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ....

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	617.00	617.00	637.00
STORAGE	72.	72.	669.
OUTFLOW	0.	0.	5405.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE ACRFT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1.00	637.[illegible]	.69	702.	7620.	.42	16.00	0.00
.50	634.16	0.00	552.	1993.	0.00	16.25	0.00

PERCENT OF PMF FLOOD ROUTING
EQUAL TO SPILLWAY CAPACITY

PREVIEW OF SEQUENCE OF STREAM NETWORK CALCULATIONS

RUNOFF HYDROGRAPH AT	10212
ROUTE HYDROGRAPH TO	10212
END OF NETWORK	

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**********
FLOOD HYDROGRAPH PACKAGE (HEC-1)
DAM SAFETY VERSION      JULY 1978
 LAST MODIFICATION  26 FEB 79
**********

 RUN  DATE= 79/07/13.
      TIME= 15.07.15.
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DAM SAFETY INSPECTION - MISSOURI
LOST LAKE DAM (MO212)
PERCENT OF PMF DETERMINATION AND ROUTING

JOB SPECIFICATION

NO	NHR	NMIN	IDAY	IHR	IMIN	METRC	IPLT	IPRT	NSTAN
300	0	5	0	0	0	0	0	4	0

JOPER	NWT	LROPT	TRACE
	0	0	0

MULTI-PLAN ANALYSES TO BE PERFORMED
NPLAN= 1 NRTIO= 9 LRTIO= 1

RTIOS=	.75	.76	.77	.78	.79	.80	.81	.82	.83

********** ********** ********** ********** **********

SUB-AREA RUNOFF COMPUTATION

INPUT PRECIPITATION INDEX, RATIOS, AND UNIT HYDROGRAPH PARAMETERS

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
MO212	0	0	0	0	0	1	0	0

HYDROGRAPH DATA

IHYDG	IUHG	TAREA	SNAP	TRSDA	TRSPC	RATIO	ISNOW	ISAME	LOCAL
1	2	1.06	0.00	1.06	1.06	0.000	0	0	0

PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.75	100.00	120.00	135.00	0.00	0.00	0.00

LOSS DATA

LROPT	STRKR	DLTKR	RTIOL	ERAIN	STRKS	RTIOK	STRTL	CNSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	-1.00	-78.00	0.00	0.00

CURVE NO = -78.00 WETNESS = -1.00 EFFECT CN = 78.00

UNIT HYDROGRAPH DATA
TC= 0.00 LAG= .23

RECESSION DATA
STRTQ= 0.00 QRCSN= 0.00 RTIOR= 1.00

END-OF-PERIOD FLOW

MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q	MO.DA	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP Q

SUM 32.11 28.96 3.15 237699.
(816.1)(736.1)(80.1) 6728.85)

HYDROGRAPH ROUTING

ROUTE HYDROGRAPH THROUGH LOST LAKE DAM (10212)

ISTAQ	ICOMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
10212	1	0	0	0	0	1	0	0

ROUTING DATA

QLOSS	CLOSS	AVG	IRES	ISAME	IOPT	IPMP	LSTR
0.0	0.000	0.00	1	1	0	0	0

NSTPS	NSTDL	LAG	AMSKK	X	TSK	STORA	ISPRAT
1	0	0	0.000	0.000	0.000	-617.	-1

STAGE	617.00	617.50	618.00	619.00	623.00	628.00	630.75	632.25	633.70	635.10
	636.50	636.80	637.00	637.90	638.60					
FLOW	0.00	13.00	47.00	59.00	65.00	72.00	75.00	599.00	1590.00	2923.00
	4564.00	5019.00	5495.00	6274.00	11767.00					
CAPACITY=	0.	33.	72.	123.	414.	669.	815.			
ELEVATION=	605.	614.	617.	620.	631.	637.	640.			

CREL	SPWID	COOW	EXPW	ELEVL	COOL	CAREA	EXPL
617.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

DAM DATA

TOPEL	COOD	EXPD	DAMWID
637.0	0.0	0.0	0.

PEAK OUTFLOW IS 4705. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 4815. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 4920. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5024. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5174. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5323. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5461. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5596. AT TIME 16.00 HOURS

PEAK OUTFLOW IS 5732. AT TIME 16.00 HOURS

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PEAK FLOW AND STORAGE (END OF PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOW IN CUBIC FEET PER SECOND (CUBIC METERS PER SECOND)
AREA IN SQUARE MILES (SQUARE KILOMETERS)

OPERATION	STATION	AREA	PLAN	RATIO 1 .75	RATIO 2 .76	RATIO 3 .77	RATIO 4 .78	RATIO 5 .79	RATIO 6 .80	RATIO 7 .81	RATIO 8 .82	RATIO 9 .83
HYDROGRAPH AT	1:212	1.64 (2.75)	1	7926. (224.44)	8037. (227.47)	8177. (231.42)	8242. (233.41)	8349. (236.41)	8454. (239.40)	8560. (242.39)	8666. (245.38)	8771. (248.38)
ROUTED TO	1:212	1.64 (2.75)	1	4795. (135.78)	4815. (136.35)	4926. (139.53)	5004. (141.73)	5174. (146.52)	5321. (150.72)	5461. (154.64)	5596. (158.47)	5732. (162.33)

SUMMARY OF DAM SAFETY ANALYSIS

PLAN 1 ***********

	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
ELEVATION	617.00	617.00	637.00
STORAGE	72.	72.	660.
OUTFLOW	0.	0.	5405.

RATIO OF PMF	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.75	635.59	0.00	652.	4705.	0.00	16.00	0.00
.76	635.87	0.00	665.	4815.	0.00	16.00	0.00
.77	636.15	0.00	678.	4920.	0.00	16.00	0.00
.78	636.42	0.00	691.	5024.	0.00	16.00	0.00
.79	636.67	0.00	704.	5124.	0.00	16.00	0.00
.80	636.93	0.00	716.	5223.	0.00	16.00	0.00
.81	637.19	0.00	728.	5321.	0.00	16.00	0.00
.82	637.43	.01	741.	5416.	.01	16.00	0.00
.83	637.68	.03	753.	5732.	.08	16.00	0.00


FILME
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